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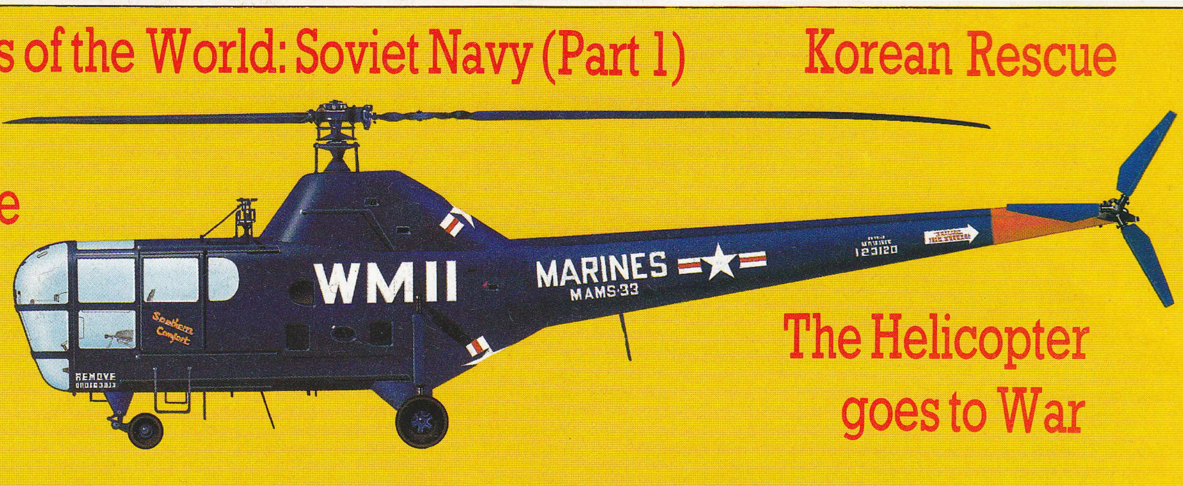
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WAR MACHINE

Volume 8 **Issue 96**

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Editorial Offices
War Machine
Aerospace Publishing Ltd
179 Dalling Road
London W6 0ES

Managing Editor: Stan Morse
Editorial: Trisha Palmer
Chris Bishop
Chris Chant
Ian Drury

Design: Rod Teasdale
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Artists:
Keith Woodcock
I. Hasegawa

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Subscription Manager: Christine Allen
0488 72666

Consultant Editor: Major General Sir Jeremy Moore KCB OBE MC, Commander of British Land Forces during the Falklands campaign.

Distribution and marketing offices:
Orbis Publishing Ltd
Orbis House
20-22 Bedfordbury
London WC2N 4BT
Telephone: 01-379 6711

Circulation Director: David Breed
Marketing Director: Michael Joyce

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Cover photograph: A Bristol Belvedere of No. 66 Squadron, Royal Air Force, is seen in Borneo during the Indonesian confrontation.

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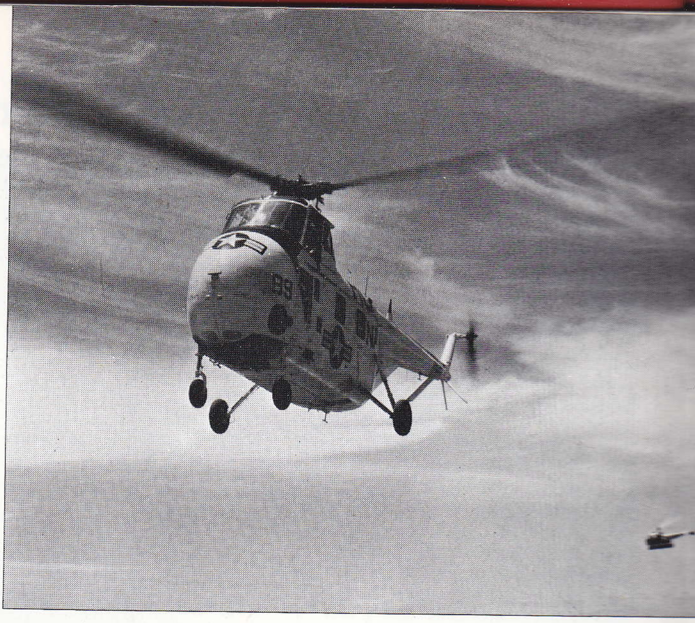
Post-War Helicopters



The military value of an aircraft that was independent of runways and could land and take off in difficult terrain was well appreciated during World War II, but it was not until the post-war years that practical machines were put into production. During the 1950s helicopters began to undertake what were at the time novel tasks of battlefield casualty evacuation, command liaison and search and rescue.

One area where the rapid development of the helicopter was welcome was at sea, where it revolutionized communications, supply and anti-submarine warfare. This HRS-3 (the US Navy version of the Sikorsky S-55) is about to land on the icebreaker USS Glacier *in 1958.*

Although the concept of rotary winged flight has exercised man's ingenuity for centuries, it was not until the 20th century and the advent of the internal combustion engine that such aircraft could become a reality. Even so, the challenge presented by the technical problems encountered ensured that the development of the helicopter would be a long process.

The first practical helicopters suitable for military use made their appearance during World War II, with Germany producing both small observation machines and larger multi-purpose aircraft in some numbers. At the same time, Igor Sikorsky was the leading light in American helicopter development, and I.P. Bratukhin was head of a Soviet design team producing even larger and more powerful machines.

To the military, the prospect of being able to move men and equipment by air into areas unsuitable for conventional aircraft was attractive. Trials were arranged during the last years of war, and helicopters operated off ships and in climatic conditions ranging from Alaskan winter to Burmese monsoon. By the outbreak of war in Korea, the military helicopter was being adapted to tasks ranging from seaborne search and rescue, through battlefield casualty evacuation to carrying generals about their commands.

It was not until the mid 1950s that the change which was to make the helicopter an essential feature of the modern battlefield came about. Up until that time power was provided by the piston engine, which was heavy, prone to failure and rattled the airframe unmercifully. 1955 saw the first flight of the turbine-powered Aérospatiale Alouette II, whose smooth, lightweight powerplant opened the way to higher speeds and payloads together with much increased safety.

Before long both the USAF and the US Army were converts to the helicopter. From the start, the air force saw the helicopter as a means of rescuing downed pilots, but the late 1950s saw the first expression of the concept of air mobility. Shown here are Piasecki H-21s in US service.

FRANCE

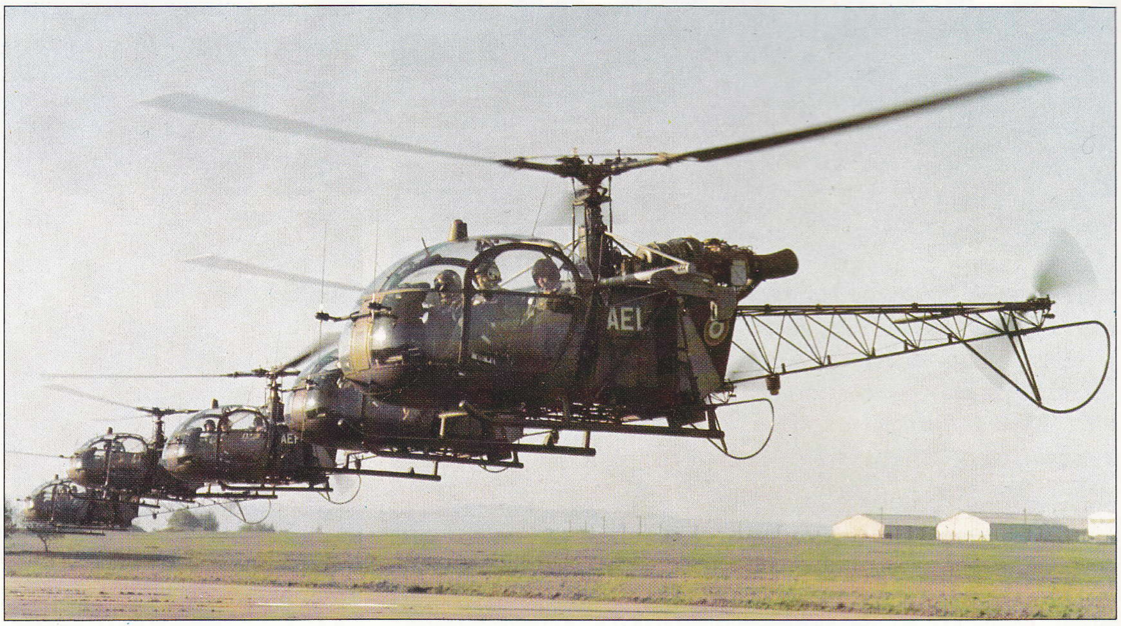
Aérospatiale SE 313B Alouette II

Of conventional configuration but sturdy design, the **Aérospatiale Alouette II** was one of the first true light multi-purpose helicopters and excelled in a variety of roles. This adaptability was facilitated by its reliable turboshaft engine, easy maintenance, and landing gear which could be either of wheel or skid type, or floats, with provision for emergency flotation gear.

The Alouette II originated as the **Sud-Est SE 3120 Alouette** (lark), a three-seat light helicopter designed mainly for agricultural purposes. The first SE 3120 prototype was flown on 31 July 1952, powered by a 149.1-kW (200-hp) Salmson 9NH radial engine, and a year later established a new international helicopter closed-circuit duration record of 13 hours 56 minutes. The basic airframe was then completely redesigned to take the 268.5-kW (360-shp) Turboméca Artouste I turboshaft, and the first of two prototypes, designated **SE 3130**, was flown on 12 March 1955, followed by three pre-production aircraft in 1956. The Alouette II was granted a French certificate of airworthiness on 2 May 1956, and was soon in demand on the international market. In 1957 Sud-Est merged with Sud-Aviation, at which time the designation of the Alouette II was altered to SE 313 B, remaining unchanged after Sud's take-over by Aérospatiale.

From the beginning, the Alouette II proved a most successful design and was found particularly suitable for operations in higher altitudes. Thus, during the period 9-13 June 1958, an Artouste-powered Alouette II set up a helicopter altitude record of 10981 m (36,027 ft) for all classes, and a height record of 9583 m (31,440 ft) in the 1000/1750-kg (2,205/3,858-lb) category. By September 1960 no less than 598 Alouette IIs had been ordered by customers in 22 different countries and the type was being assembled by Republic in the USA and Saab in Sweden. It also became the first French aircraft of any kind, and the first helicopter in the world, to be granted an American certification.

In the military role, the Alouette II can be fitted with a wide variety of rockets, missiles and guns.



French commanders were the first to see the potential of light helicopters such as these Alouettes as mobile HQs, and it was while leading his men from an Alouette that Colonel Jeanpierre of the 1st REP was killed.

Specification

Aérospatiale SE 313B Alouette II

Type: light general-purpose helicopter

Powerplant: one 395.2-kW (530-shp) Turboméca Artouste II C6 turboshaft, derated to 268.5 kW (360 shp)

Performance: (at maximum take-off weight) maximum speed at sea level 185 km/h (115 mph); maximum cruising speed at sea level 165 km/h (103 mph); rate of climb at sea level 282 m (925 ft) per minute; service ceiling 2150 m (7,055 ft); hovering ceiling in ground effect 1650 m (5,415 ft); hovering ceiling out of ground effect 920 m (3,020 ft); range with maximum fuel at sea level 565 km (351 miles); range with 545-kg (1,202-lb) payload at sea level 100 km (62 miles); range with 390-kg (860-lb) payload at sea level 300 km (186 miles); flight endurance with maximum fuel at sea level 4 hours 6 minutes

Weights: empty 895 kg (1,973 lb); maximum take-off 1600 kg (3,527 lb)

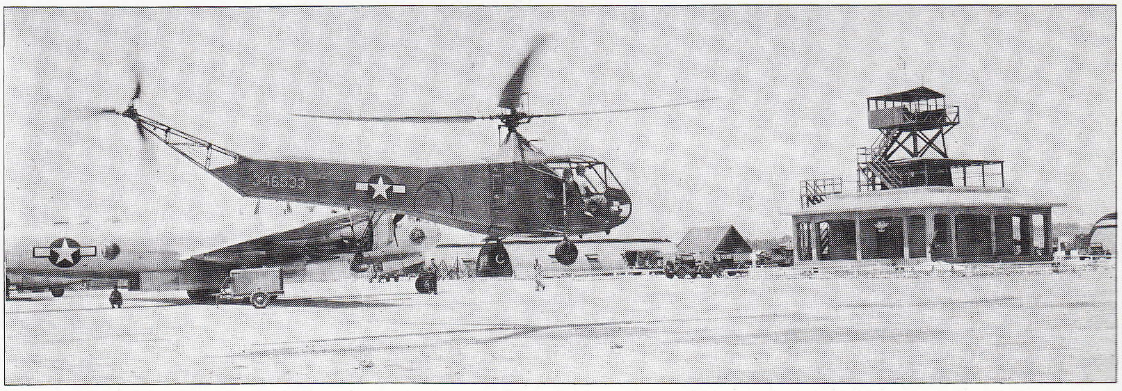
Dimensions: main rotor diameter 10.20 m (33 ft 5.6 in); diameter of tail rotor 1.81 m (5 ft 11.3 in); length (rotor blades folded) 9.70 m (31 ft 9.9 in); height 2.75 m (9 ft 0.3 in); main rotor disc area 81.70 m^2 (879.4 sq ft)

USA

Vought-Sikorsky R-4 and R-6

Deriving its place in history from the fact that it was the first helicopter ordered in quantity for service with the US forces, Sikorsky's initial production helicopter was based on the VS-300 of 1939. A prototype of the two-seat **XR-4** conducted its maiden flight on 13 January 1942, followed by three pre-series **YR-4A** (134.2-kW/180-hp Warner R-550-1) and 41 **YR-4B** (with a larger cabin) helicopters. Seven of the latter went to the US Navy as **HNS-1** machines. All bore the company designation **Vought-Sikorsky VS-316A**, and as a result of their gross weight increasing from the prototype's 1111 kg (2,450 lb) to 1315 kg (2,900 lb) they suffered a drastic fall of top speed from 164 km/h (102 mph) to 121 km/h (75 mph). Nevertheless the early R-4s undertook valuable trials work, including deployments in Burma and Alaska and the first US helicopter landing aboard a ship, in May 1943, preparing the way for 100 **R-4B** models (149.1-kW/200-hp R-550-3), 22 of which became HNS-1s with the US Navy and US Coast Guard. Diversions were made to the UK of two YR-4As, five YR-4Bs and 45 R-4Bs, these mainly serving the Royal Navy as the **Hoverfly Mk I**, apart from one forwarded to the Royal Canadian Air Force. The sole **XR-4C** was the original prototype modified in 1943 with an R-550-1 in place of its 123-kW (165-hp) R-500-3 and its 10.97-m (36-ft) main rotor replaced by the larger unit introduced from the YR-4A onwards.

Metal skinning replaced fabric on the more streamlined **VS-316B** or **R-6**, a prototype of which flew on 15 October 1943, powered by a 167.8-kW (225-hp) Franklin O-437-7. Five pre-series XR-6A helicopters with the 179-kW (240-hp) O-435-9 included three passed to the US Navy as the **XHOS-1**, although main production was by Nash-Kelvinator Corp of 26 **YR-6A** and 193 **R-6A** helicopters. Of the 193, the US Navy absorbed 38 as the **HOS-1**, while the UK received only 43 of a planned 150 **Hoverfly Mk II** helicopters mainly for the RAF, and supplied one of these to Canada. Problems with the R-6A's engine shortened service life and led to plans for an **R-6B** powered by a Lycoming O-435-7 of 167.8-kW (225 hp), but this failed to emerge, as did the **R-7**, which would have had a 179-kW (240-hp) O-405-9.



A Vought Sikorsky R-4 comes in to land by the side of a B-29 Superfortress on the Marianas Islands a few weeks after the end of the war.

Specification

Vought-Sikorsky YR-4B

Type: two-seat general-purpose helicopter

Powerplant: one 134.2-kW (180-hp) Warner R-550-1 radial piston engine

Performance: maximum speed 121 km/h (75 mph); climb to 2438 m (8,000 ft) in 45 minutes; service ceiling 2438 m (8,000 ft); range 209 km (130 miles)

Weights: empty 916 kg (2,202 lb); maximum take-off 1150 kg (2,535 lb)

Dimensions: main rotor diameter 11.58 m (38 ft 0 in); fuselage length 10.79 m (35 ft 5 in); height 3.78 m (12 ft 5 in); main rotor disc area 105.36 m^2 (1,134.1 sq ft)

Armament: none

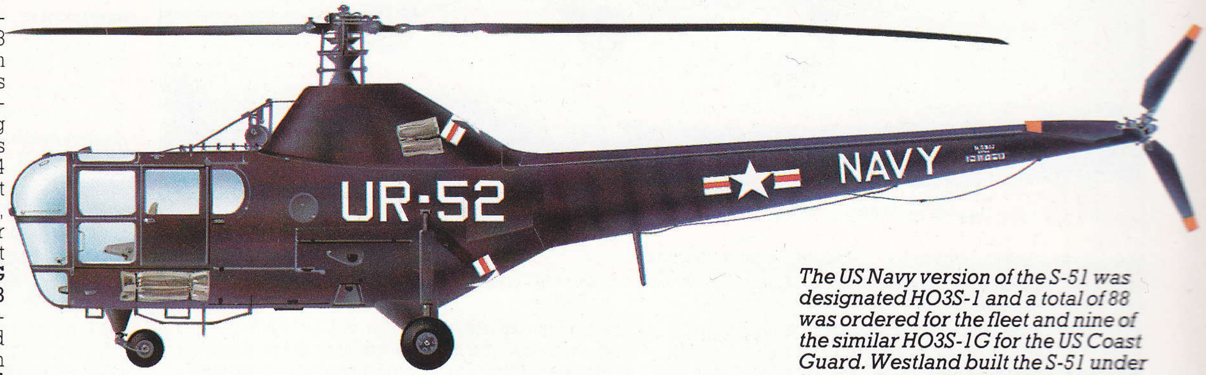
USA

Vought-Sikorsky R-5

Known to its manufacturer as the **Vought-Sikorsky VS-327**, the **R-5** derived from earlier demonstrations of helicopter viability by the R-4 and a USAF requirement issued in 1943 for an observation helicopter. Five **XR-5** prototypes were acquired and flew from 18 August 1943 onwards, two of them later being fitted with British equipment and redesignated **XR-5A**. A pre-production series of 26 **YR-5A** helicopters, two of them transferred to the US Navy (and later to the US Coast Guard) as the **HO2S-1**, was followed by only 34 of a planned 100 **R-5A** SAR models which saw operational use with the Air Rescue Service as its first helicopter. The type had provision for a stretcher mounted externally on each side of the fuselage, and 20 (plus a single YR-5A) were converted to **R-5D** standard with a nosewheel landing gear, a rescue hoist and provision for a second internal passenger. The **YR-5E** was a dual-control trainer conversion of five YR-5As. The nosewheel, an extra 30.5 cm (12 in) of rotor span, four seats and a maximum weight of 2812 kg (6,200 lb) characterized the civil **Sikorsky S-51** of 1946, 11 of which entered USAAF service in 1947, designated **R-5F**, followed by 19 hoist-equipped **H-5G** helicopters in 1948 (the earlier aircraft also adopting 'H' in place of 'R'). Finally, 16 **H-5H** models were ordered in 1949 with interchangeable wheel or pontoon landing gear and a 2948-kg (6,500-lb) gross weight. The US Navy cancelled 34 more HO2S-1 helicopters, but bought 88 H-5F variants known as the **HO3S-1**, for duties including aircraft carrier plane-guard, while the US Coast Guard obtained nine similar **HO3S-1G** helicopters. The designation **XHO3S-3** was used by a rotor test-bed modification, and **HO3S-2** was the unadopted naval H-5H. In the UK Westland began licensed manufacture of the **Westland WS-51 Dragonfly** during 1948 and produced 137, mostly for the RAF and Royal Navy, followed by 12 mainly civil **Widgeon** helicopters featuring a redesigned five-seat cabin. Dragonflies undertook experimental helicopter passenger and mail services, and pioneered SAR and casualty evacuation with the armed forces. Military models comprised the Royal Navy **Dragonfly HR.Mk 1** and **Dragonfly HR.Mk 3**; and the **Dragonfly HC.Mk 2** and VIP **Dragonfly HC.Mk 4** of the RAF. Dragonfly export customers included Ceylon, Egypt, France, Iraq, Italy, Thailand and Yugoslavia, plus Brazil and Jordan with Widgeons.

Specification
Vought-Sikorsky R-5B
Type: SAR/general-purpose helicopter
Powerplant: one 335.6-kW (450-hp) Pratt & Whitney R-985-AN-5 radial piston engine
Performance: maximum speed 171 km/h (106 mph); climb to 3048 m (10,000 ft) in 15 minutes; service ceiling 4389 m (14,400 ft); range 579 km (360 miles)
Weights: empty 1715 kg (3,780 lb); maximum take-off 2189 kg (4,825 lb)
Dimensions: main rotor diameter 14.63 m (48 ft 0 in); fuselage length 12.45 m (40 ft 10 in); height 3.96 m (13 ft 0 in); main rotor disc area 168.11 m^2 (1,809.56 sq ft)
Armament: none

Designed concurrently with the XR-6, the R-5 was a tandem two-seater helicopter powered by a 335.6-kW (450-hp) Pratt & Whitney engine and was used by the US Navy, US Coast Guard and the Air Rescue Service.



The US Navy version of the S-51 was designated HO3S-1 and a total of 88 was ordered for the fleet and nine of the similar HO3S-1G for the US Coast Guard. Westland built the S-51 under licence in the UK as the Westland Dragonfly with Leonides engine.

USA

Bell Model 47

On 8 December 1945 Bell flew the prototype of a classic helicopter design, the **Bell Model 47**. On 8 March 1946 this was awarded the first approved type certificate issued for a civil helicopter anywhere in the world. The Model 47 remained in continuous production by Bell into 1973, and was also built under licence by Agusta in Italy from 1954 to 1976. The Model 47 has been used on a large scale by armed forces all over the world, its simplicity and low cost more than outweighing its limited capabilities.

In 1947 the USAF (then USAAF) procured 28 of the improved **Model 47A**, powered by 117.1-kW (157-hp) Franklin O-335-1 piston engines, for service evaluation: 15 were designated **YR-13**, three **YR-13A**s were winterized for cold-weather trials in Alaska, and the balance of 10 went to the US Navy for evaluation as **HTL-1** trainers. Little time was lost by either service in deciding that the Model 47 was an excellent machine, and the orders began to flow in.

The US Army's first order was issued in 1948, 65 being accepted under the designation **H-13B**; all US Army versions were later named **Sioux**.

US Navy procurement began with 12 **HTL-2** and nine **HTL-3** helicopters, but the first major version was the **HTL-4**.

The Model 47 has been built under licence by Agusta in Italy, Kawasaki in Japan, and Westland in the UK (the **Model 47G-2** for the British army, with the name Sioux), and in various roles Model 47s have served with more than 30 armed services.

Experimental versions have been numerous. Perhaps the two most important were the **Model 201** (service designation **XH-13F**) and the **Model 207 Sioux Scout**. The Model 201 was powered by a Continental XT51-T-3 (licence-built Turboméca Artouste) turboshaft. The Model 207 was the first true armed helicopter: powered by the 193.9-kW (260-hp) turbocharged Avco Lycoming TVO-435-A1A piston engine, the Sioux Scout featured a revised cabin seating two in tandem, small stub wings containing additional fuel and helping to offload the main rotor in forward flight, and a remotely controlled chin barbette, containing two 7.62-mm (0.3-in) M60 machine-guns, and movable 200° in azimuth, with elevation from −45° to +15°.

Bell's production of Model 47s eventually came to an end in late 1973, versions of the **Model 47G-5** being the last to be built.

Specification
Bell Model 47G-5A
Type: general utility helicopter
Powerplant: one 197.6-kW (265-hp) Avco Lycoming VO-435-B1A flat-six piston engine
Performance: maximum speed at sea level 169 km/h (105 mph); cruising speed 137 km/h (85 mph) at 5,000 ft (1525 m); service ceiling 3200 m (10,500 ft); range with maximum fuel 412 km (256 miles)
Weights: empty equipped 786 kg (1,732 lb); maximum take-off 1293 kg (2,850 lb)
Dimensions: main rotor diameter 11.32 m (37 ft 1.5 in); tail rotor diameter 1.78 m (5 ft 10 in); length, rotors turning 13.30 m (43 ft 7.5 in); height 2.84 m (9 ft 3.75 in); main rotor disc area 100.61 m^2 (1,083.0 sq ft)

Simple, cheap and reliable, the Bell Model 47 first flew in 1945 and remained in production until 1976. Seen here before its debut in Korea, a US Army H-13 passes over a mixed column of M4 (Sherman-derived) battle tanks including an M4A3E8 'Easy Eight'.

The Helicopter Goes to War

A machine capable of vertical take-off has obvious military qualities, a fact recognized by Germany and the USA in World War II. It needed a few more years of development before the helicopter was reliable enough to go to war.

The first use of the helicopter in Korea was humanitarian: the evacuation of wounded troops to the rear. The Sikorsky R-5 proved many of the concepts used later, such as slinging litters to take stretcher cases not able to fit into the small cabins of the day.

Though Leonardo da Vinci is often credited with the invention of the helicopter concept in the last quarter of the 15th century, he was in fact inspired by children's toys working on the helicopter principle, and such toys had been popular in ancient China, where they were known as 'bamboo dragonflies'. Despite this early start, however, it took the period up to World War II and the genius of Sikorsky to produce the first practical military helicopter, the R-4, generally used for rescue work. Since the idea had been around for some 500 years, it could have been expected that the military would immediately see the incredible potential that the helicopter offered. Perhaps inevitably, the military did not.

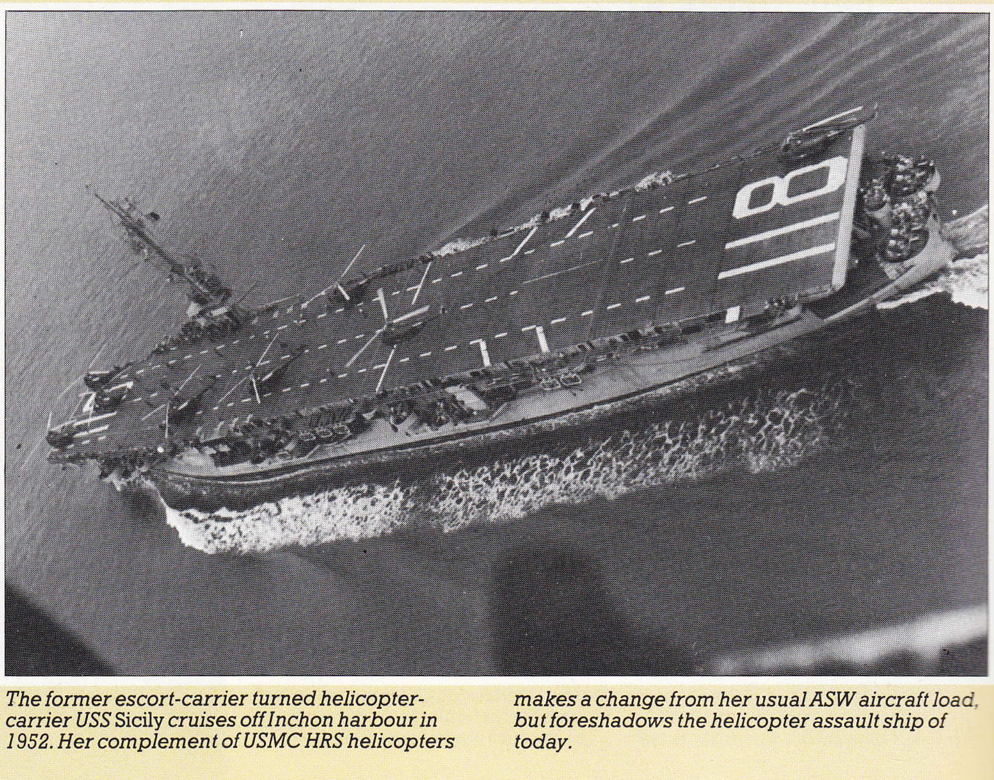
Medevac

Helicopters were originally seen as being ideal for medical evacuation (medevac), but little suited for other roles. They were not powerful enough to transport the large quantities of men and equipment then needed to wage war (remember that a well-equipped platoon of the 1980s could probably outgun a company of the 1940s). When the Korean War broke out, Bell 47s were extensively used for medevac, but they could carry only two (possibly three) stretcher cases at a time. No one had thought of using them for special forces type operations, largely because special forces as such did not exist (except for British army field security detachments, which swanned around the battlefield doing who knows what).

However, the new Sikorsky S-55 (operated by the US Army as the H-19) was an altogether larger 'chopper'. It could carry up to 10 soldiers, or eight stretchers and one medic. It would seem that this aircraft would enable the military to develop some interesting tactics, and indeed the first use made of the H-19 seemed to do just that. Even while it was on its original proving trial in Florida, the test pilot, one Captain Joseph D. Cooper, was told to report, with chopper, to Seoul. A field security detachment had isolated a crashed Mikoyan-Gurevich MiG-15 fighter on a sand bar behind enemy lines, and some unsung genius in G-2 (US Army intelligence) had realized that a helicopter would be the ideal way of flying in technicians to strip the MiG of its more interesting parts, and then to fly out the parts; the technicians had to make their own way back through enemy lines. This is exactly what happened, the H-19 performing brilliantly in the hands of Cooper. But that was it, and the H-19s were then used only for medevac, except by the US Marines, who used their HRS versions for medevac and utility flights, later expanded to supply and troop drops. This use did not catch on with the rest of the UN forces fighting in Korea; but interestingly enough, it was to be the British Navy/Royal Marines who would show how helicopters could be used in a more aggressive role.

Indochina

Meanwhile, while Korea was going on, the French were having their own problems in Indo-China. In 1950, French forces had two Hiller 360s (made in the USA). By the time of Dien Bien Phu in 1954 they had 42 choppers, a mix of Hillers, and Sikorsky H-5s and H-19s. Once again they were used exclusively for medevac until Dien Bien Phu itself, when there occurred an incident that totally soured the French on using helicopters even for medevac, and in so doing affected the conduct of the Algerian war. Very simply, the French used helicopters with Red Cross markings to rescue some downed pilots: such evacuation of non-wounded personnel is contrary to the rules of war, and while the Viet Minh stood for it the first

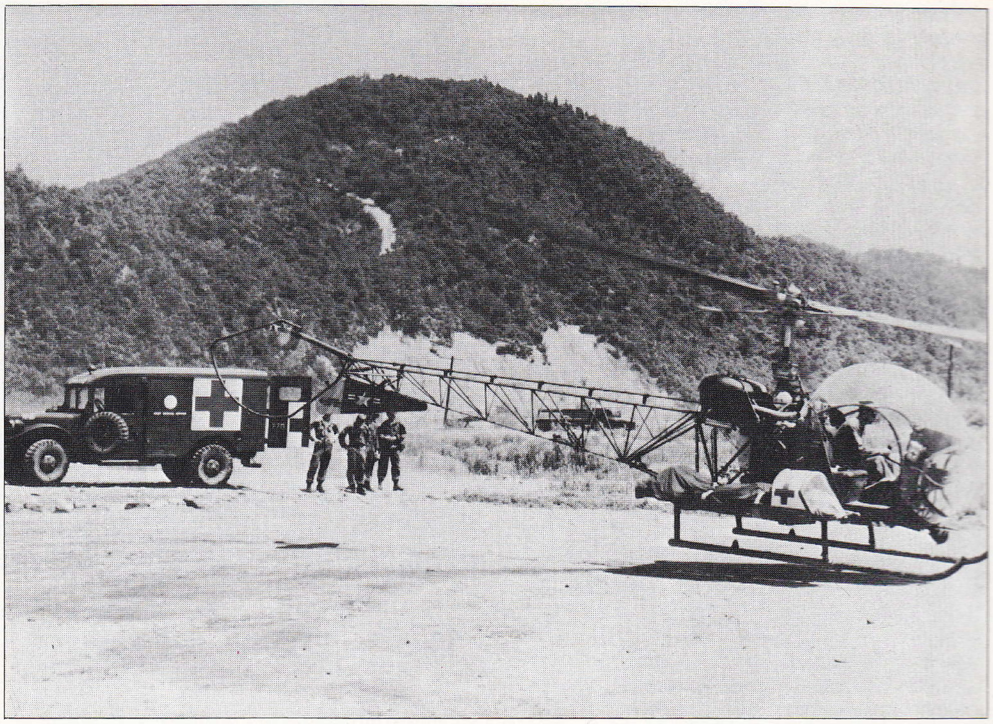


The former escort-carrier turned helicopter-carrier USS Sicily cruises off Inchon harbour in 1952. Her complement of USMC HRS helicopters makes a change from her usual ASW aircraft load, but foreshadows the helicopter assault ship of today.

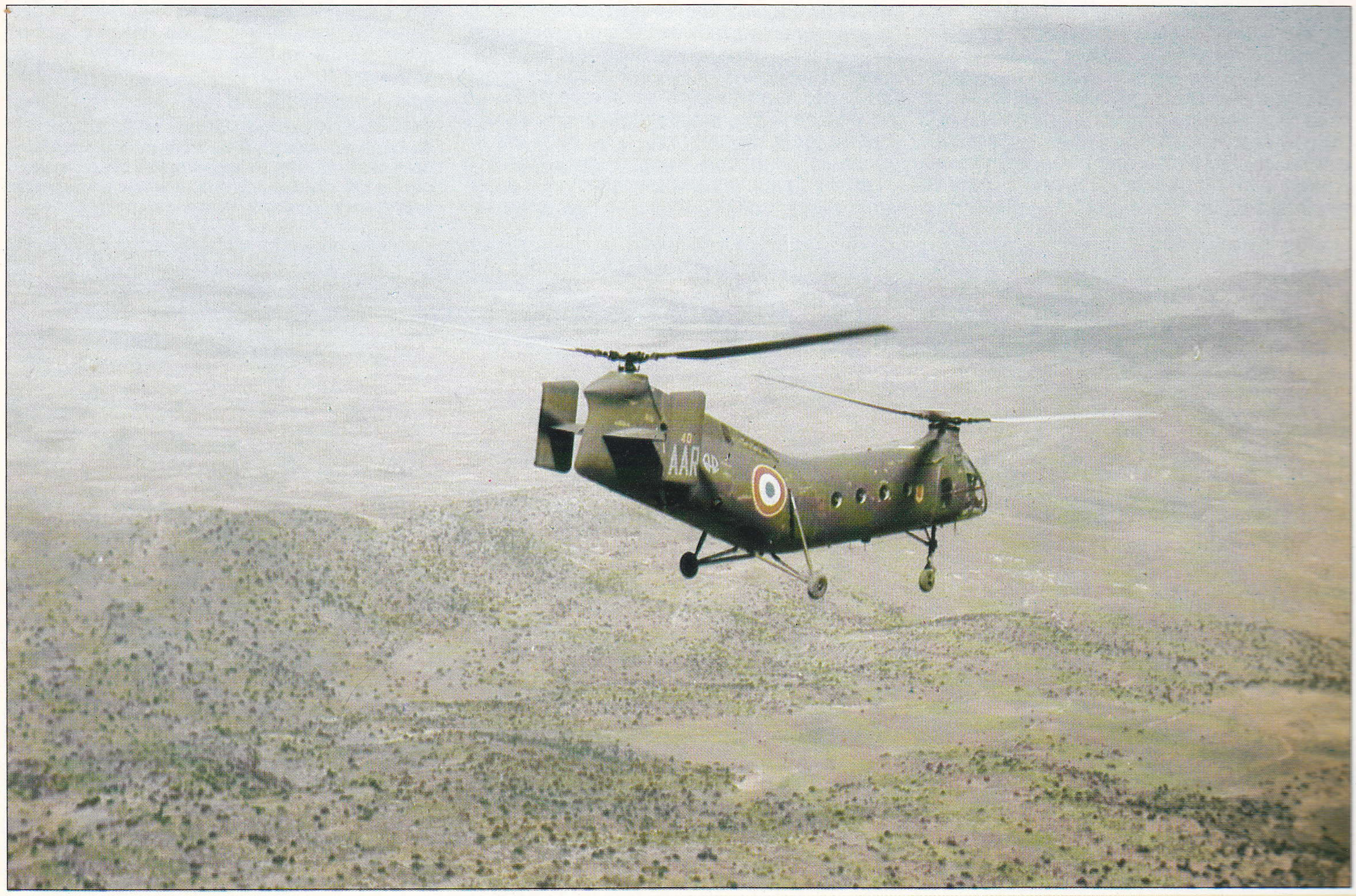
time, they later blew two helicopters out of the sky. At this point the French stopped chopper flights, and the use of helicopters in warfare went on the back shelf.

In 1956, at the US Army Aviation School at Fort Rucker, Alabama, a certain Colonel Jay Vanderpool had obtained permission to form a 'Sky Cavalry Platoon'. Even though he was able to demonstrate the helicopter's manoeuvrability and potential firepower, the brass were not impressed (they were probably still reeling from the fact that the tank had replaced the horse) and the platoon became known as 'Vanderpool's Fools'. It was perhaps small recompense that Vanderpool's platoon would later in Vietnam become the US Army's Air Cavalry, which was one of the most effective units under American command.

Meanwhile (there were an awful lot of wars going on in the 1950s), the British had become embroiled in Malaya. This 'Emergency' cannot be compared strictly with Vietnam or Algeria; there were far fewer terrorist troops on the ground; they did not have even the passive support of the majority of the local population; there was not a corrupt and alienated 'local' government in power; and the British were reasonably popular. The British also were lucky enough to have two men (Generals Briggs and Templer) who were to prove themselves geniuses in the art of counter-insurgency warfare. The basic principle was to isolate the terrorists from their food supplies (unwilling villagers) and to force them to concentrate in certain areas, where they could be destroyed.

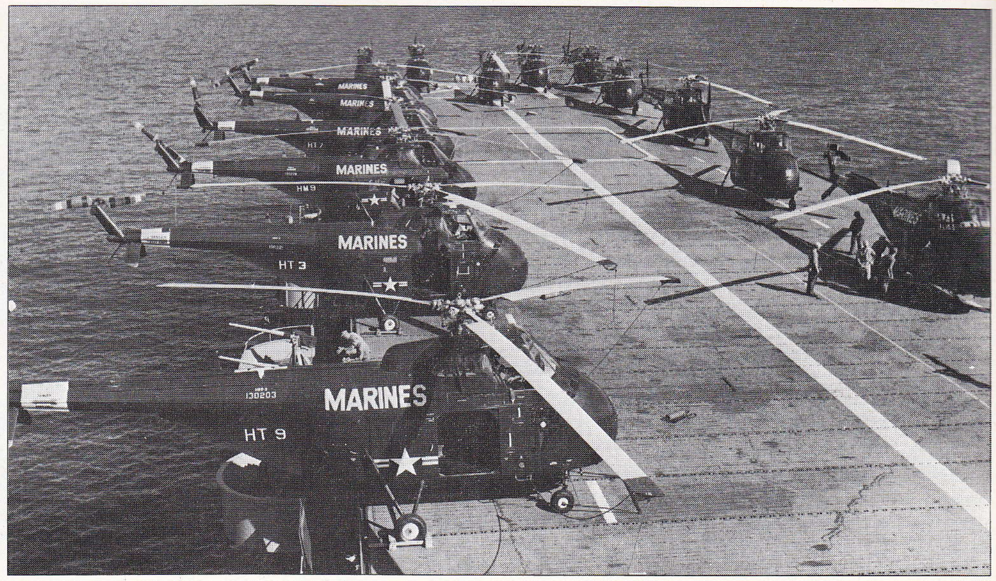


Above: On 23 July 1953, 'somewhere in Korea', a wounded soldier is evacuated from a front-line dressing station. The Bell H-13 helicopter will have the casualty at an airstrip in minutes, and he will be in a hospital in Japan in a few hours.



The French army widely employed the Piasecki H-21 in Algeria during the closing stages of the conflict. Using tactics forged in the jungles of Malaya, the H-21s achieved great success in the desert and did much to dispel the French worry over the use of helicopters after Dien Bien Phu.

This strategy did depend on British troops spending long periods in the jungle, where supply obviously became a problem. The RAF had not shown much interest in helicopters, and only possessed lightweight craft that were not large enough for the job. But the Royal Navy, which is responsible for resupplying the Royal Marines, seized the opportunities offered by the helicopter with both hands. Royal Marine Commandos hidden away in the *ulu* (jungle) could be supplied by helicopter easily and efficiently. Small raiding parties could be easily airlifted into position, and helicopters began to be used in a far more aggressive role.



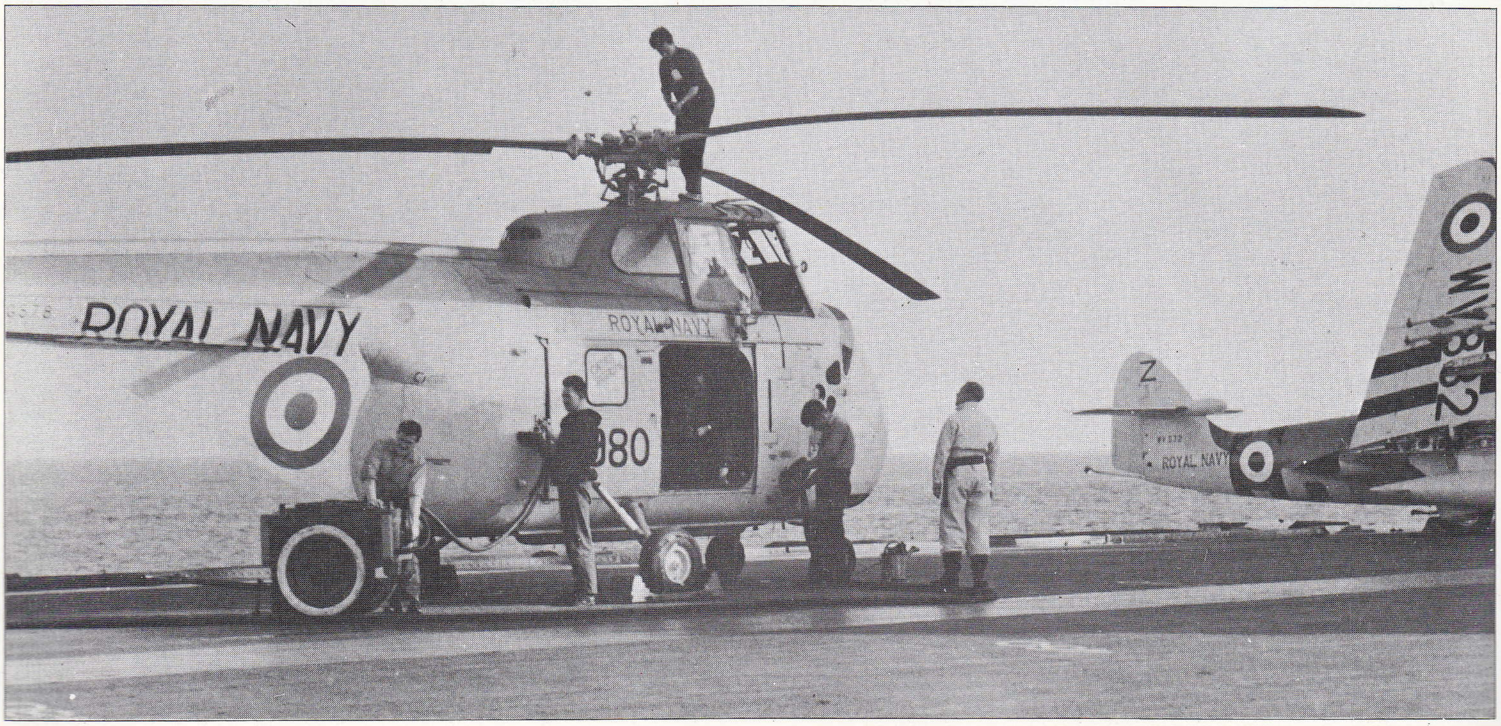
The US Marine Corps welcomed the troop-carrying helicopter, seeing in it a means of avoiding the worst aspects of making an amphibious assault. The use of large numbers of troop-carrying helicopters such as these of VMR-261 and VMR-262 aboard USS Siboney *enabled coastal defences to be bypassed by 'vertical envelopment'.*

Helicopters in Algeria

It was a lesson that the French in Algeria were slow to discover for themselves. Soured by their experience at Dien Bien Phu, the French hardly used helicopers at all until the closing stages of the Algerian war. The French initially relied heavily on paradrops to pursue the rebels, a tactic dictated as much by the fact that the Légion Etrangère were amongst the finest parachute troops in the world as by the demands of local conditions. It was not until General Challe of the French air force became commander-in-chief during December 1958 that helicopters began to come into their own. Using the principles established by Briggs and Templer in Malaya, Challe developed a highly mobile helicopter force that could act as reinforcement for para operations or could be used in areas where paradrops were impossible. Culminating in Operation 'Jumelle' in the Kabyle mountains in July 1959, these tactics proved extremely effective, but by then it was too late. The politicians had decided, and once again men, women and children on both sides proved to have died in vain.

The debate about how helicopters should be used had been going on since the end of World War II. This debate was between those who saw helicopters as flying ambulances or supply trucks, and those who saw helicopters as heralding a new type of warfare, where greater speed and mobility could make up for fewer troops, particularly since those (fewer) troops would be equipped with vastly improved weaponry. The French had successfully experimented with the firing of rockets from helicopters during the Algerian war, and obviously machine-guns could also be used. It is easy to see why such a controversy should take place in the first instance: to develop the helicopter in the latter role would and did require an enormous financial commitment in terms of equipment and training. And counter-insurgency warfare, where the helicopter was to win its aggressive spurs, was very much a post-World War II phenomenon. But even during British operations in the Radfan (up-country from Aden) during the mid-1960s, paradrops were still the method of choice of getting infantry in place quickly, although the SAS on one occasion sent in a pathfinder team (to prepare the drop zone) by chopper, only to rediscover that a few determined enemy troops (in this case Yemeni tribesmen) could make a paradrop very uncomfortable, not to mention dangerous. On this particular occasion it was the Royal Marines who got into position first, having walked there, which did not do very much for the traditional rivalry between para and marine!

A Westland Whirlwind (licence-built Sikorsky S-55) is seen aboard HMS Albion *during the Suez operations of 1956. Helicopters had become part of a carrier's regular complement, performing air/sea rescue tasks as well as general utility duties.*



A Bristol Sycamore deploys British troops in the battle against EOKA terrorists in Cyprus. The helicopter gave the British a great advantage in counter-insurgency operations, enabling small units to be inserted without warning in formerly inaccessible country.

However, the SAS and Royal Marines were to use choppers to good effect during operations in the Trucial Oman States; by this time the helicopter's value had been established, even though it was being mainly used by special forces. For the British at least it took Borneo to establish how vital the helicopter could be with regular troops.

The Malaysian Conflict

The 'confrontation' between Indonesia and the fledgling far-flung country of Malaysia was a war in all but name. It happened because the establishment of Malaysia ran counter to Indonesia's own territorial ambitions, and the Indonesian president, Sukarno, was under great pressure (notably from his foreign minister) to export Indonesia's own brand of socialism. And, of course, there is nothing like a good, patriotic war to divert one's citizens from the fact that there are grave problems at home. Accordingly, Indonesia openly supported dissident, minority groups in Borneo, large tracts of which Indonesia claimed for itself. Sukarno declared a 'Confrontation' and it was left to the British to sort the mess out, because at that time the Malaysian armed forces were no match for the Indonesians. (The Indonesian marines, for example, were an extremely well trained force, which probably accounts for the Indonesian reluctance to use them against British troops except in the very beginning: it is always embarrassing to have one's best troops defeated.) The problems were formidable. Initially, there were only five British battalions to cover 1600 km (1,000 miles) of jungle frontier, and the Indonesian troops could and did cross at any point they chose. Extreme mobility was demanded, and the chopper really came into its own. Border intelligence was gathered by SAS mobile patrols and by static forward intelligence officers (FIOs) based in friendly kampongs, and usually guarded by a small detachment of Ghurkas. (The majority of these FIOs were in fact NCOs from the Intelligence Corps, and when this was pointed out to the War Office, it insisted that they be called forward intelligence non-commissioned officers, or FINCOs, and the I Corps suddenly became known as the 'finks'. Still, it made someone in the War Office happy.)

'Hearts and minds'

FIOs and FINCOs alike did a superb job of border watching, but could not have done so without the use of the chopper. They were used for resupply, for evacuating sick villagers, for dropping SAS patrols in otherwise inaccessible areas (or at least, accessible but too late) and, on at least one occasion, flying a pig into a kampong as a gift from the British on the occasion of the marriage of the village chief's daughter. 'Hearts and minds' played a vital role in Borneo, and those teams of Royal Engineers who spent months on the border clearing helicopter landing sites in likely areas also found time to build dams and fix the village water pump.

At the end of September 1963, 150 Indonesians crossed the border and attacked the village of Long Jawi, killing one Gurkha, one policeman and one Border Scout. The British retaliated swiftly. A main force was sent to recapture Long Jawi and, secure in the knowledge that the Indonesians would not stick around, other smaller forces were helicoptered into position to cut their line of retreat. The operation worked, and thereafter the technique of ambushing retreating Indonesians played an ever important part in winning the war.

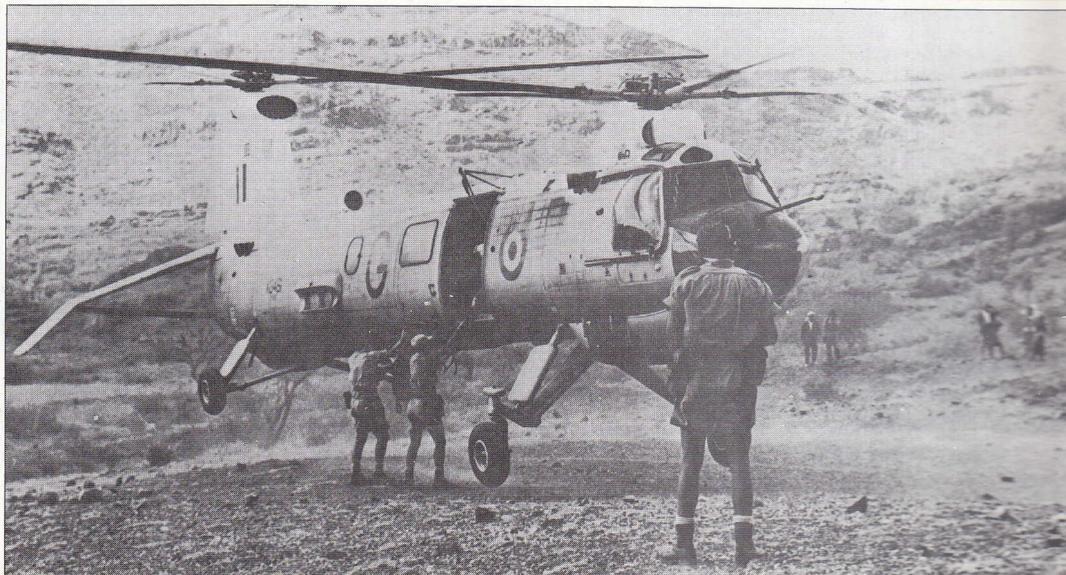
By the end of 1965, there were 14,000 British troops in Borneo, and because the helicopter allowed such mobility, most of them were combat troops. The Indonesians tended to send parties of between 100 and 250 men across the border in an attempt to expand Indonesian territory on the basis of occupation. British bases close to the border had to be big (up to company strength) to contain these incursions, but at the same time small enough to be defended by a platoon because of manpower limitations. Again, the chopper provided the key because a platoon could now be reinforced to company level in a very short space of time.

British lessons learnt in Borneo were not wasted on the Americans. Almost too great a reliance was placed upon helicopters in Vietnam, and no amount of military hardware can make up for political interference, mismanagement and stupidity. But many British observers felt that the Air Cavalry was one of, if not the most efficient arm in Vietnam. It was then that the helicopter gunship was developed and that helicopters won the respect and affection of the average soldier. Indeed, one of the favourite sayings in Vietnam was 'give me a huss' for 'do me a favour', huss being HUS (Helicopter, Utility, Sikorsky).

And now the rocket-armed helicopter is seen as being an effective defence against tanks, particularly in Europe.

It seems only apt that the two most recent military weapons (tank and chopper) should be pitted against each other: do not be surprised if the chopper wins.

By the 1960s the helicopter had become an essential component of the military scene. Its use in combat varied from the massed Air Cavalry operations in Vietnam to re-supply missions for single posts in the Radfan, as by this Belvedere.



USA

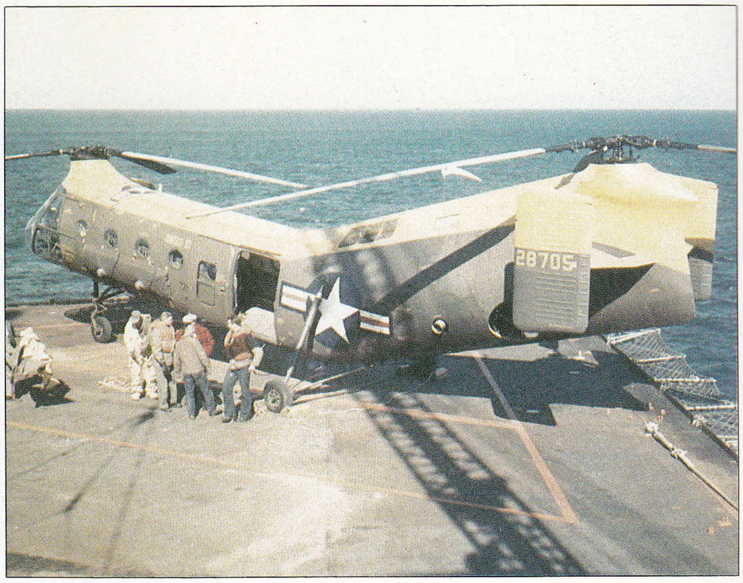
Piasecki H-21

Developed from the US Navy's HRP-2, the **Piasecki PD-22** tandem-rotor helicopter prototype (US Air Force designation **XH-21**) was first flown on 11 April 1952. Eighteen **YH-21** helicopters had been ordered in 1949 for USAF evaluation, these being followed by an initial production batch of 32 **H-21A** helicopters, named **Workhorse** in USAF service. For use by the Military Air Transport Service Air Rescue Service, the H-21As were each powered by a derated 932.1-kW (1,250-hp) Wright R-1820-103 engine; the first flew in October 1953. Six more were built to USAF contract but supplied to Canada under the Military Assistance Program.

The second production variant was the **H-21B**, which used the full power of the 1062.6-kW (1,425-hp) R-1820-103 to cover an increase in maximum take-off weight from 5216 kg (11,500 lb) to 6804 kg (15,000 lb). Some 163 were built, mainly for Troop Carrier Command, and these had autopilots, could carry external auxiliary fuel tanks, and were provided with some protective armour. They could carry 20 troops in the assault role.

The US Army's equivalent was the **H-21C Shawnee**, of which 334 were built. This total included 98 for the French army, 10 for the French navy and six for Canada; 32 Shawnees were supplied to West Germany, serving with the army's Heeresfliegerbataillon 300. The H-21C, redesignated **CH-21C** in July 1962, had an underfuselage sling hook for loads of up to 1814 kg (4,000 lb). Production deliveries were made between September 1954 and March 1959, later helicopters acquiring the company designation **Model 43** when the Piasecki Helicopter Corporation became the Vertol Aircraft Corporation in 1956. The H-21A and H-21B retrospectively became the **Model 42**.

Two turboshaft conversions of H-21C airframes were the **Model 71 (H-21D)**, with two General Electric T58 engines first flown in September 1957, and the **Model 105** which had two Avco Lycoming T53s. From the latter was designed the Vertol 107 (Boeing Vertol H-46 series).



The Air Rescue Service took the initial production batch of 34 H-21s and christened the type 'Workhorse'. The H-21As were powered by a 932-kW (1,250-hp) engine, giving a maximum take-off weight of over 5000 kg (11,500 lb).

Specification
Piasecki H-21C Shawnee

Type: troop/cargo transport

Powerplant: one 1062.6-kW (1,425-hp) Wright R-1820-103 Cyclone radial piston engine

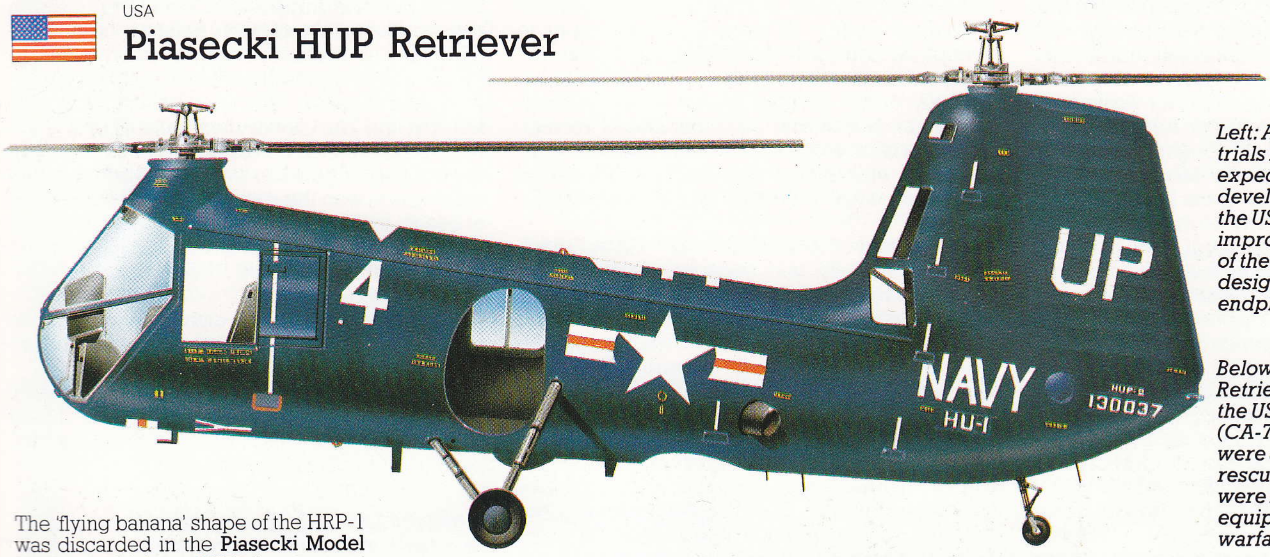
Performance: maximum speed 211 km/h (131 mph) at sea level; service ceiling 2362 m (7,750 ft); range 644 km (400 miles)

Weights: empty 3629 kg (8,000 lb); maximum take-off 6668 kg (14,700 lb)

Dimensions: rotor diameter, each 13.41 m (44 ft 0 in); length, rotors turning 26.31 m (86 ft 4 in); height 4.70 m (15 ft 5 in); rotor disc area, total 282.52 m^2 (3,041.07 sq ft)

USA

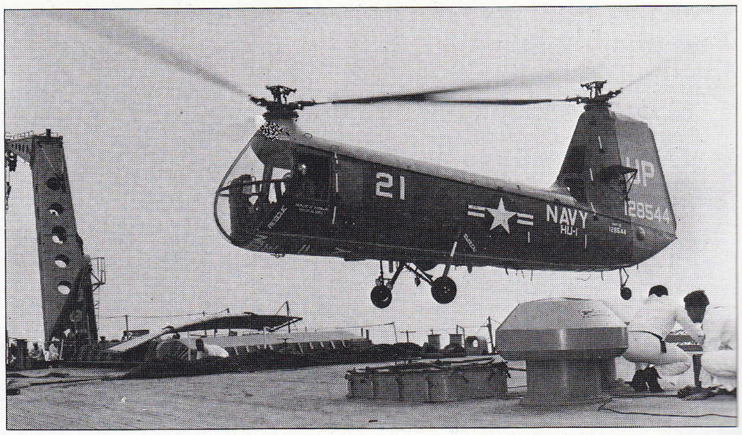
Piasecki HUP Retriever



Left: After the Sperry autopilot trials fulfilled every expectation, the HUP-2 was developed and 193 supplied to the US Navy. The significantly improved directional stability of the HUP-2 enabled the designers to dispense with the endplate fins.

The 'flying banana' shape of the HRP-1 was discarded in the **Piasecki Model PV-14**, of which two **XHJP-1** prototypes were ordered for evaluation in the rescue and aircraft-carrier planeguard roles. This model was developed into the **PV-18**, US Navy designation **HUP-1 Retriever**, which featured angled endplate fins on the horizontal tail surfaces mounted to the rear rotor pylon. Some 32 HUP-1s, each powered by a single 391.5-kW (525-hp) Continental R-975-34 engine, were built for the US Navy between February 1949 and 1952; the first squadron, HU-2, took delivery of its initial aircraft in February 1951.

Successful Sperry autopilot trials in an XHJP-1 led to development of the **HUP-2**, whose improved directional stability allowed the endplate fins to be deleted, and the more powerful 410.1-kW (550-hp) R-975-46 engine was fitted. A total of 339 was built, including 193 for the US Navy. A number of these were designated **HUP-2S** when fitted with dunking sonar equipment for anti-submarine operations. Some 15 HUP-2s were also supplied to the French navy. The US Army ordered an initial batch of an improved version in 1951, this being known as the **H-25A Army Mule**. Powered by the R-975-46A engine, the H-25A introduced power-boosted controls, strengthened floors and enlarged cargo doors. Fifty similar machines were transferred to the US Navy under the designation **HUP-3**, three serving with the Royal Canadian Navy's Squadron VH-21. Under the unified designation system introduced in September 1962, the HUP-2 and HUP-3 were redesignated **UH-25B** and **UH-25C**.



Below: A Piasecki HUP-2 Retriever lands on the fantail of the US Navy cruiser USS Helena *(CA-75). Although most HUPs were assigned to search and rescue missions, a number were fitted with dunking sonar equipment for anti-submarine warfare.*

Specification
Piasecki HUP-3

Type: utility/cargo helicopter

Powerplant: one 410.1-kW (550-hp) Continental R-975-46A radial piston engine

Performance: maximum speed 169 km/h (105 mph); service ceiling 3048 m (10,000 ft); maximum range 547 km (340 miles)

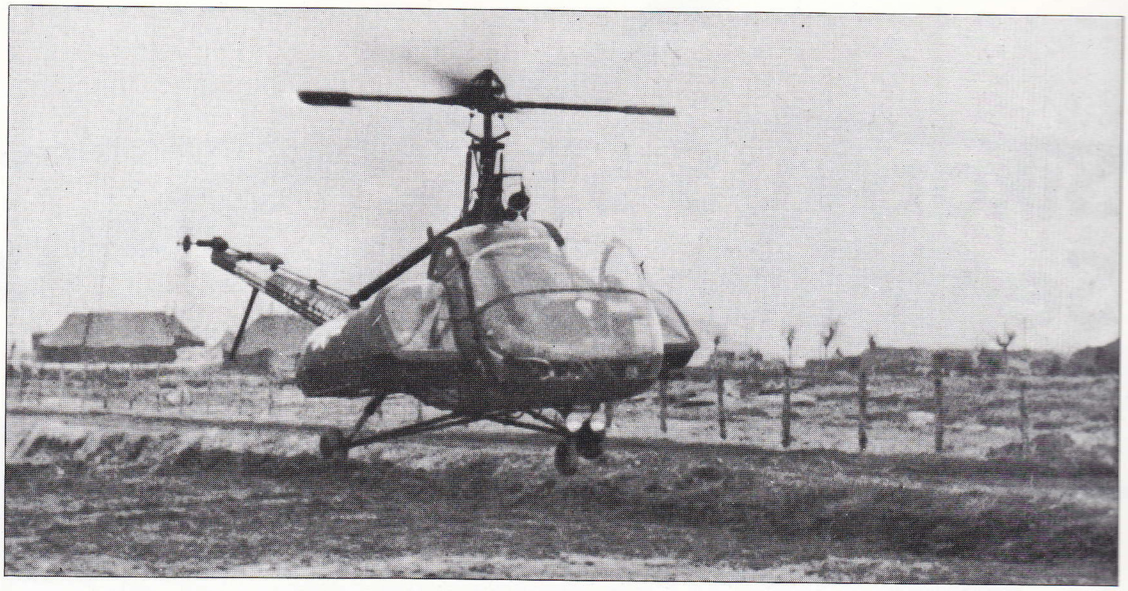
Weights: empty 1782 kg (3,928 lb); maximum take-off 2767 kg (6,100 lb)

Dimensions: rotor diameter, each 10.67 m (35 ft 0 in); length, rotors turning 17.35 m (56 ft 11 in); height 3.81 m (12 ft 6 in); rotor disc area, total 178.76 m^2 (1,924.23 sq ft)

USA

Hiller Model 360, UH-12 and OH-23 Raven

Hiller Helicopters Inc. was formed in 1942 for the development and production of rotary-wing aircraft. Early work on the **Hiller Model XH-44, UH-4 Commuter**, and the **UH-5** which introduced a newly-developed 'Rotor-Matic' rotor control system, led to the **Hiller Model 360** prototype. The company's first production helicopter followed and this, known as the **Hiller UH-12** since Hiller had become part of United Helicopters, was of simple construction, incorporating a two-blade main rotor and a two-blade tail rotor on an upswept boom. The design was highly successful, being built extensively in two- and three-seat configurations for both civil and military use, and an early Model 12 was the first commercial helicopter to record a transcontinental flight across the United States. More than 2,000 were built before production ended in 1965, some 300 of this total being exported, and throughout this period the power and capability of the helicopter was steadily improved.



Overshadowed to some extent by the Bell and Sikorsky designs, the Hiller H-23 made a significant contribution to helicopter operations in the Korean war. This example has just collected casualties from Yoju for evacuation to a casualty station.

The commercial **UH-12A** to **UH-12D** became the **OH-23A** to **OH-23D Raven** respectively for service with the US Army, and the US Navy acquired UH-12As as **HTE-1** and **HTE-2**. The **UH-12E** was basically a three-seat dual control version of the OH-23D and was built also as the military **OH-23G**. A lengthened-fuselage four-seat civil **UH-12E4** was produced as the military **OH-23F**, and later civil versions with uprated powerplant included the UH-12E variants suffixed **L3, L4, SL3** and **SL4**. OH-23s were exported to Argentina, Bolivia, Colombia, Chile, Cuba, Dominica, Guatemala, Guyana, Mexico, Morocco, the Netherlands, Paraguay, Switzerland, Thailand and Uruguay. The Canadian army acquired OH-23Gs which it operated with the designation **CH-112 Nomad**, and the Royal Navy used a number of ex-US Navy HTE-2s under the designation **Hiller HT.Mk2**.

At the height of UH-12/OH-23 production Hiller was acquired by the Fairchild Stratos Corporation to form Fairchild Corporation, but in 1973 a new Hiller Aviation company was formed, acquiring from Fairchild design rights and production tooling for the UH-12E, and initially continued to provide support for the worldwide fleet of UH-12 helicopters. In the mid-1970s production of the UH-12E was restarted, and versions available currently from this company include the UH-12E, a four-seat **UH-12E4**, and turbine-powered equivalents designated **UH-12ET** and **UH-12E4T** respectively. These have as powerplant a 313.2-kW (420-shp) Allison 250-C20B turboshaft which is derated to 224.5 kW (301 shp) in this application.

Specification

Hiller OH-23D Raven

Type: three-seat military helicopter

Powerplant: one 240.9-kW (232-hp) Avco Lycoming VO-540-A1B flat-six piston engine

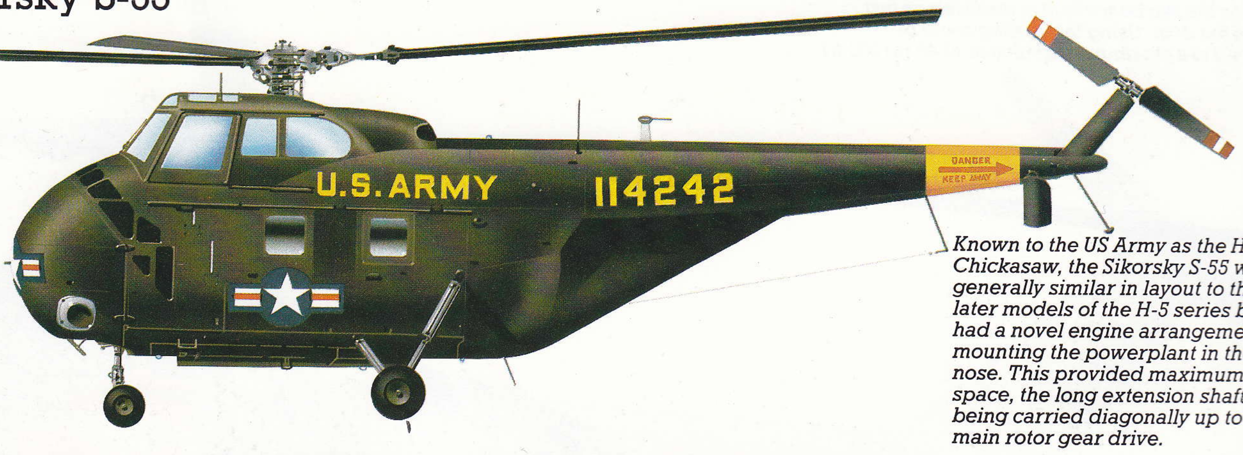
Performance: maximum speed 153 km/h (95 mph); cruising speed 132 km/h (82 mph); service ceiling 4025 m (13,200 ft); range 330 km (205 miles)

Weights: empty 824 kg (1,816 lb); maximum take-off 1225 kg (2,700 lb)

Dimensions: main rotor diameter 10.82 m (35 ft 6 in); length 8.53 m (28 ft 0 in); height 2.97 m (9 ft 9 in); main rotor disc area 92.47 m^2 (995.38 sq ft)

USA

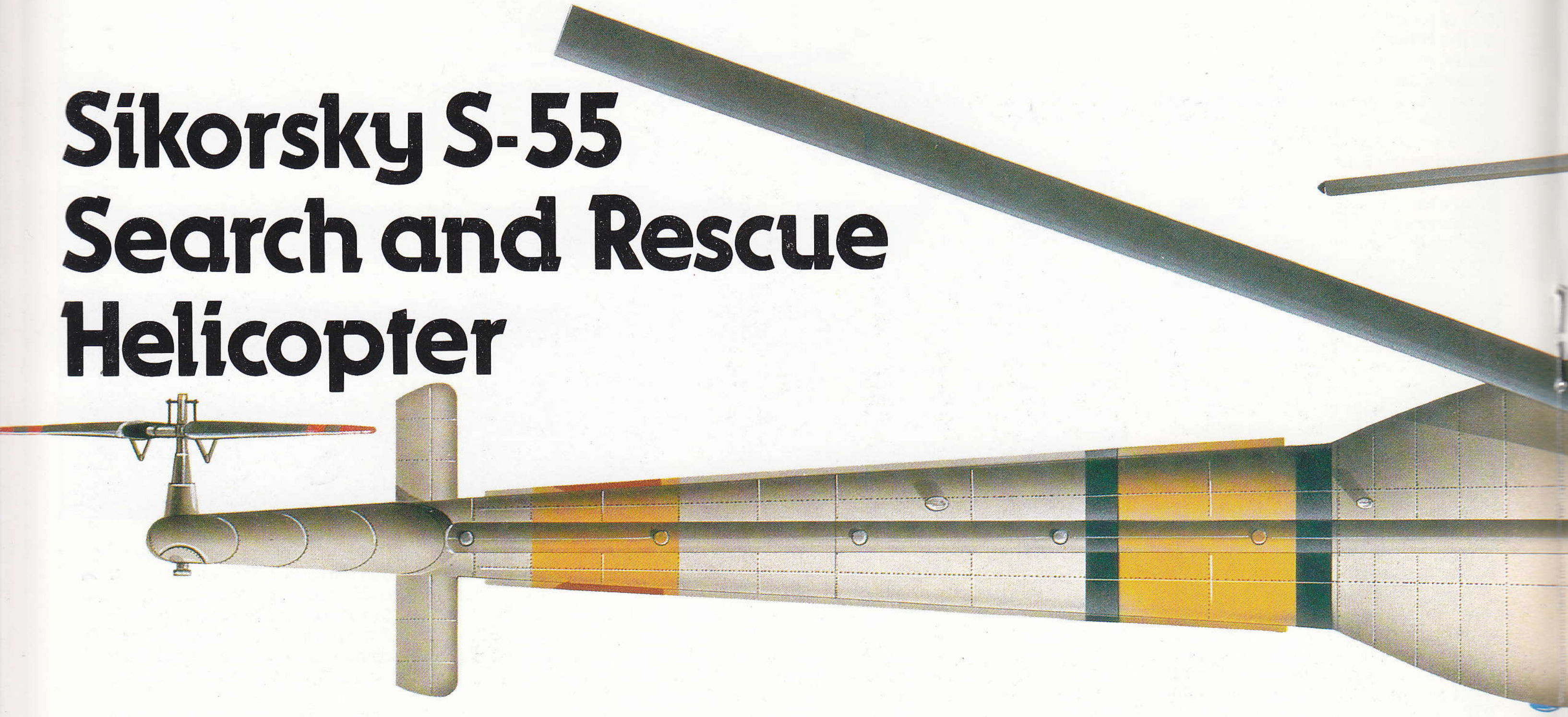
Sikorsky S-55



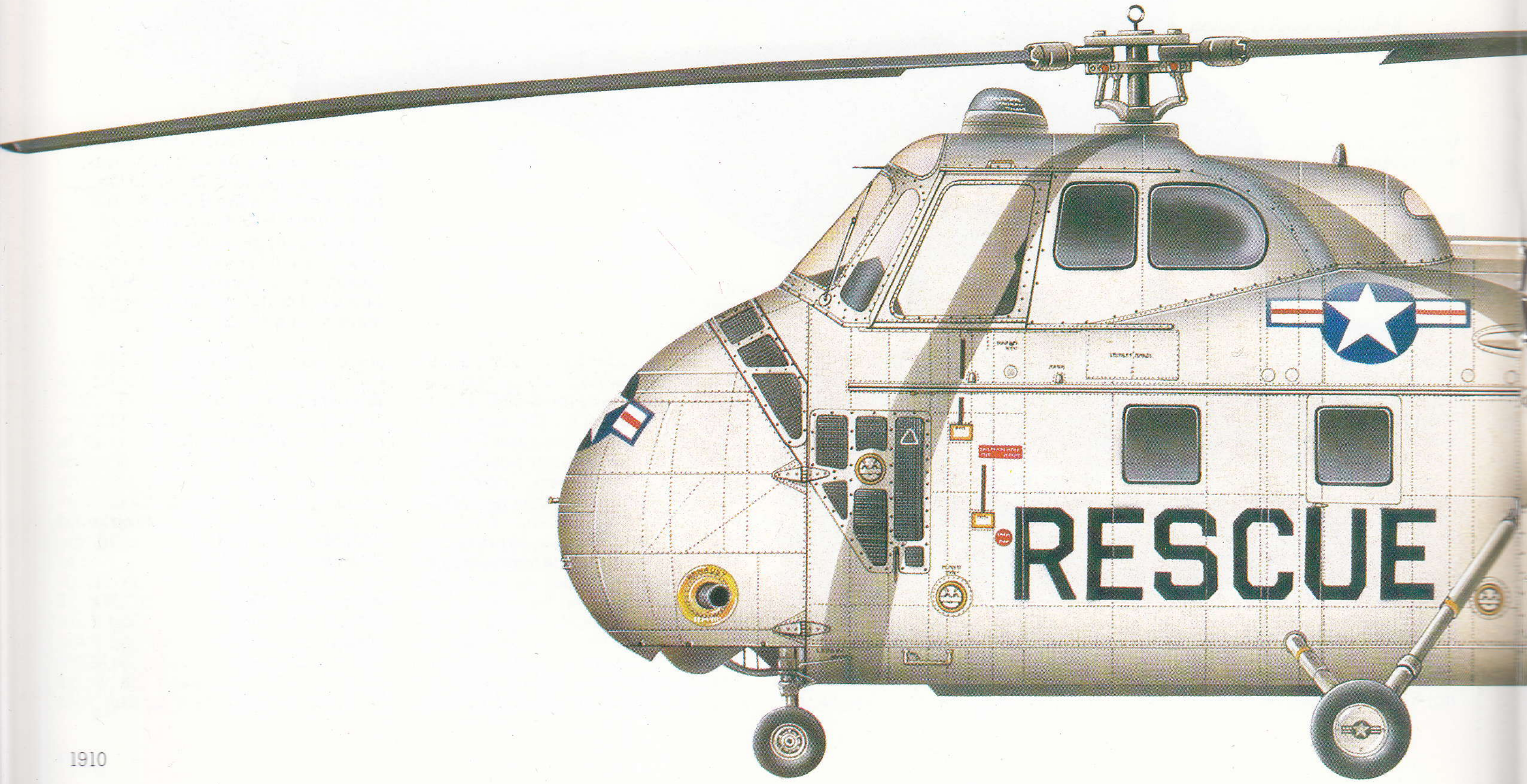
Known to the US Army as the H-19 Chickasaw, the Sikorsky S-55 was generally similar in layout to the later models of the H-5 series but had a novel engine arrangement, mounting the powerplant in the nose. This provided maximum cabin space, the long extension shaft being carried diagonally up to the main rotor gear drive.

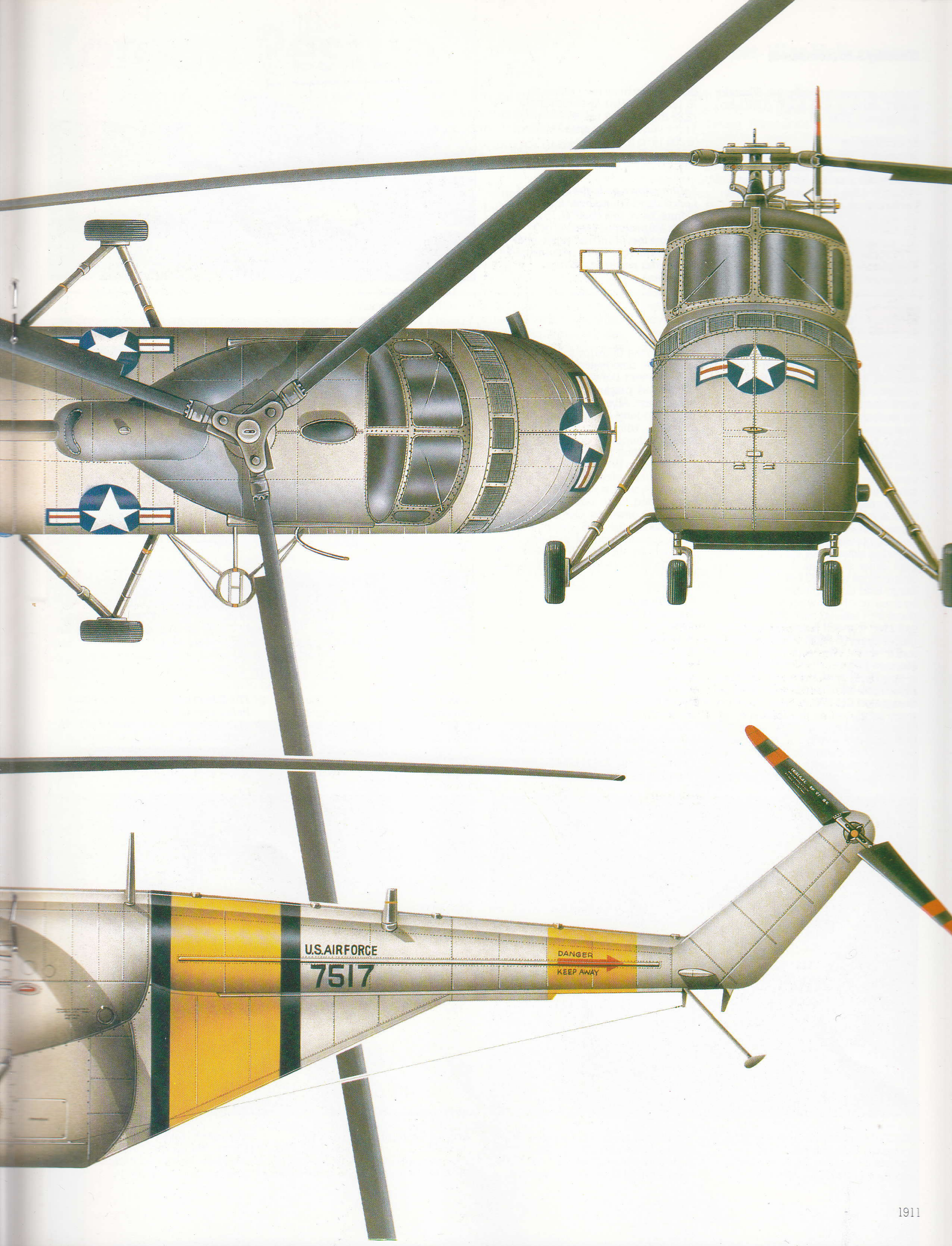
Expanding its horizons with ever larger and more operationally useful helicopters, Sikorsky flew the prototype **YH-19** (company designation **Sikorsky S-55**) on 10 November 1949 with the 410.1 kW (550 hp) of a Wright R-1340-57 piston engine. This was located in the nose for ground-level access and to provide maximum cabin space for up to 10 passengers. The USAF followed five trials YH-19s by a contract for 50 **H-19A** helicopters, some of which were converted for SAR as the **SH-19A** (later re-designated **HH-19A**). The US Army bought 72 of the **H-19C** (later **UH-19C**) type and named it **Chickasaw**. These had 447.4-kW (600-hp) R-1340 engines. Naval equivalents were the **HRS-1** and **HRS-2**, 60 and 101 of which, respectively, were used for US Marines transport. Ten of the latter were diverted to the Royal Navy and named **Whirlwind HAR.Mk 21**. Ten observation model **HO4S-1** helicopters also joined the US Navy, although the US Coast Guard failed to adopt the planned **HO4S-2**. There followed a series of models powered by a 522.0-kW (700 hp) Wright R-1300-3, comprising 105 US Marine **HRS-3** (later **CH-19E**) helicopters; 79 ASW **HO4S-3** (**UH-19F**) aircraft, including 15 supplied to the Royal Navy as **Whirlwind HAS.Mk 22**; 30 US Coast Guard **HO4S-3G** (**HH-19G**); 264 USAF **H-19B** (**UH-19B**), of which some became SAR **SH-19B** (**HH-19B**) models; and 301 US Army **H-19D** (**UH-19D**) transports. There was only civil production of the **S-55A**, with its 596.6-kW (800-hp) R-1300 engine, and the **S-55C**, which combined R-1340 power with the downward-canted tailboom (or 'broken back') introduced with the H-19B. The proposed **HRS-4** with a 764.3-kW (1,025-hp) Wright R-1820 did not materialize. Sikorsky built almost 1,300 S-55 series helicopters for civil and military use at home and abroad, but this total was swelled by licensed manufacture in Japan of 44 by Mitsubishi; in France by Sud-Est; and in the UK by Westland. The last-mentioned began with Wright R-1340 engines with the **Westland Whirlwind Srs 1**, but progressed to a 633.8-kW (850-hp) Alvis Leonides Major for the **Whirlwind Srs 2** and a 783.0-kW (1,050-hp) Bristol Siddeley Gnome H.1000 turboshaft for **Whirlwind Srs 3** aircraft. In total, Westland built 437 Whirlwinds for civil and export customers and the UK forces. Rescue and transport versions were designated **Whirlwind HAR.Mks 1, 2, 3, 4, 5, 9,** and **10**; the **Whirlwind HAS.Mk 7** was assigned to anti-submarine work; and the **Whirlwind HCC.Mk 8** and **HCC.Mk 12** served The Queen's Flight. Odd mark numbers were Royal Navy and even RAF; the Gnome was fitted in the Mks 9 to 12. Others throughout the world have modernized their aircraft with

Sikorsky S-55 Search and Rescue Helicopter



The USAF used the majority of its H-19s to equip the Military Air Transport Service (MATS) Search and Rescue helicopter squadrons, designating aircraft assigned to this role SH-19s. These helicopters were fitted with a hydraulic-electric hoist on the starboard side of the fuselage just above the door. Using this, a sling could be lowered to a maximum distance of 30.48 m (100 ft).

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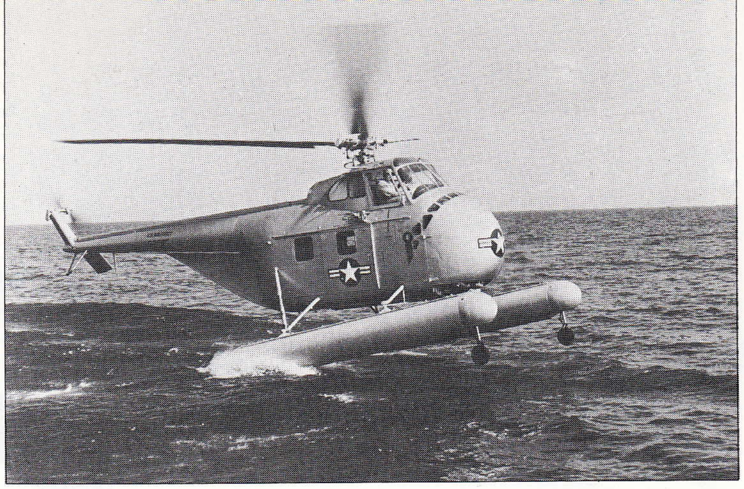
7517
DANGER
KEEP AWAY

turbine power, typically the **Sikorsky S-55T** with a 626.4-kW (840-hp) AiResearch TSE-331.

Specification
Sikorsky H-19B
Type: 10-passenger utility helicopter
Powerplant: one 596.6-kW (800-hp) Wright R-1300-3 radial piston engine
Performance: maximum speed 180 km/h (112 mph); cruising speed 146 km/h (91 mph); initial climb rate 311 m (1,020 ft) per minute; range 579 km (360 miles)
Weights: empty 2381 kg (5,250 lb); maximum take-off 3583 kg (7,900 lb)
Dimensions: main rotor diameter 16.15 m (53 ft 0 in); fuselage length 12.88 m (42 ft 3 in); height 4.06 m (13 ft 4 in); main rotor disc area 204.95 m^2 (2,206.19 sq ft)
Armament: none



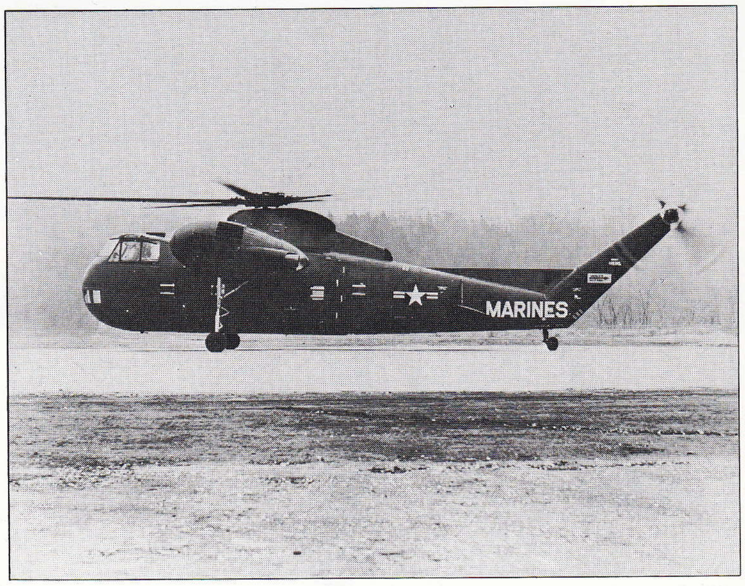
Settling down on to the surface of Long Island Sound near Bridgeport, Connecticut, this USAF H-19 shows off its amphibious landing gear during a test flight. In the medical evacuation role the H-19 could carry eight litter patients and one attendant.

USA

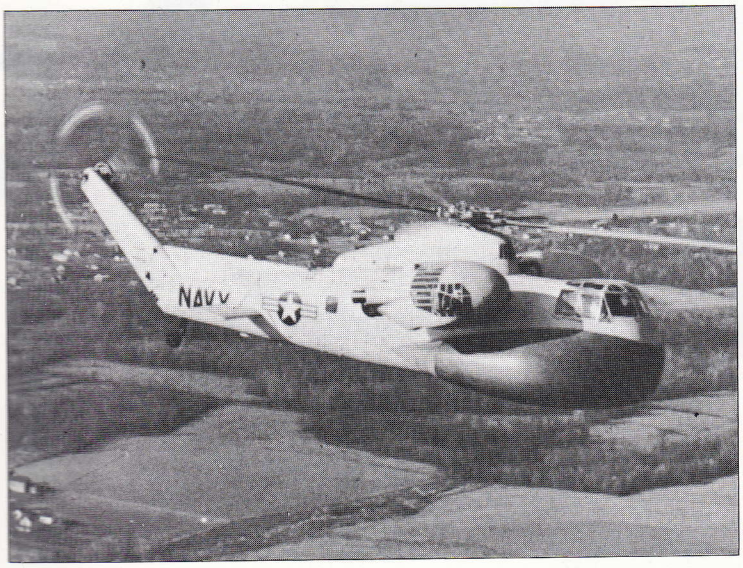
Sikorsky S-56

The ungainly **Sikorsky S-56** was produced in response to a 1950 requirement of the US Marine Corps for a transport helicopter capable of airlifting 20 troops or the equivalent in cargo, such as two jeeps. Four prototypes, designated **XHR2S-1**, made their initial flights from 18 December 1953 onwards, proving the manufacturer's first twin-engine helicopter to be one of the fastest (and largest) in the West at that time. Further claims to distinction by the aircraft were its rare employment of a retractable landing gear, and equipment with night flying aids. Installation of engines in outboard pods provided stowage for the main wheels, kept drive shafts short and reduced obstructions in the 53.8-m^3 (1,900-cu ft) cargo hold to a minimum. Entered via hydraulically-powered clamshell doors or a smaller side door, the hold included a winch hoist with monorail. Deliveries of 55 **HR2S-1** helicopters (36 more were cancelled) to the US Marines began in 1956 for equipment of three helicopter transport (medium) squadrons, and these aircraft were redesignated **CH-37C** in 1962. Two more were produced as the **HR2S-1W** airborne early warning model with a belly-mounted AN/APS-20E radar scanner and additional operating crew, but failed to stimulate a production order. More successful was the aircraft loaned to the US Army in 1954 for trials under the designation **YH-37**, as this was followed between 1956 and May 1960 by 94 production **H-37A Mojave** helicopters. All except four were modified from June 1961 onwards to **H-37B** standard, with Lear automatic stabilization equipment (to permit loading and unloading at the hover), a redesigned cargo door and crashproof fuel tanks. These were known as **CH-37B** from 1962, and the programme naturally included those based in Germany from 1959 onwards. Commercial success eluded the S-56, even though its dynamic and control systems were adopted by the later S-60, S-64, S-65 and the abortive Westland Westminster.

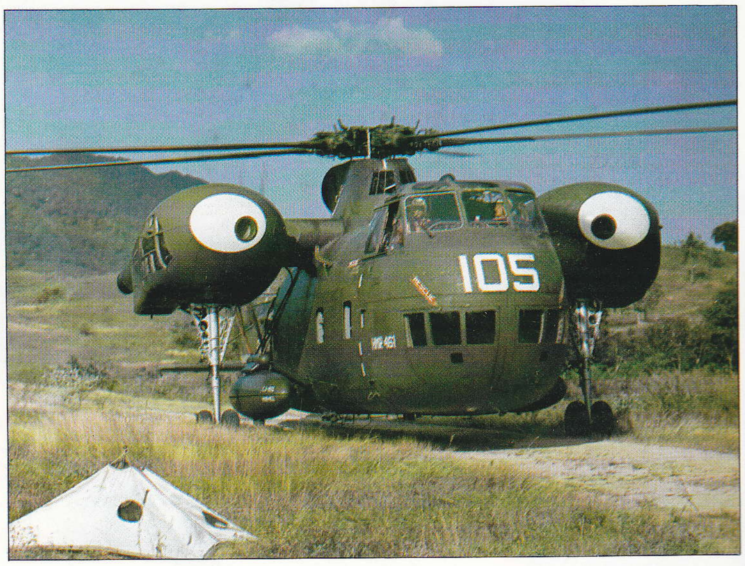
Specification
Sikorsky CH-37B Mojave
Type: transport helicopter
Powerplant: two Pratt & Whitney R-2800 Double Wasp piston engines each rated at 1416.8 kW (1,900 hp) for normal, or 1566.0 kW (2,100 hp) for emergency running
Performance: maximum speed 209 km/h (130 mph) at sea level; initial climb rate 277 m (910 ft) per minute; hovering ceiling 335 m (1,100 ft) out of ground effect; service ceiling 2652 m (8,700 ft); range 233 km (145 miles)
Weights: empty 9385 kg (20,690 lb); normal take-off 14061 kg (31,000 lb)
Dimensions: main rotor diameter 21.95 m (72 ft 0 in); fuselage length 19.76 m (64 ft 10 in); height 6.71 m (22 ft 0 in); main rotor disc area 378.24 m^2 (4,071.5 sq ft)
Armament: none



The Sikorsky S-56 was the largest helicopter to become operational with US forces up to the end of 1961. Unusually the HR2S-1, as it was known to the USMC, featured retractable landing gear and night-flying aids.



The S-56 was primarily designed as a transport helicopter to USMC specifications, but Sikorsky also produced two HR2S-1W early warning models fitted with AP/APS-20E radar in a massive bulbous nose. Although a useful concept, the AEW model failed to attract any orders.



Above: Equipping three USMC transport squadrons from 1956, the S-56 was subsequently evaluated by the US Army, which then ordered 94 machines, designated H-37 Mojave. From 1961 the army modified their H-37s by fitting Lear automatic stabilization equipment.

Korean Rescue

Popularly known as a 'Whirlybird' and at the time regarded with considerable scepticism in some quarters, the helicopter soon won acceptance in the Korean War. Ditched pilots could not survive long in the icy water off Korea, and rescue helicopters proved invaluable. Before long the helicopter's potential for clandestine missions was also noted, and the CIA acquired an all-black H-19.

1st Lieutenant Joseph M. McConnell Jr, F-86 Sabre pilot of the 39th Fighter Squadron, eventually shot down 16 MiGs to become the ranking ace of the Korean War, but on 12 April 1953 (moments after he had despatched kill number eight) it seemed that McConnell's war, and his life, were finished. The Sikorsky H-19A orbiting over the Yellow Sea island of Cho-do, a silvery, bulbous helicopter of the 3rd Air Rescue Squadron, was an unproven and not very reassuring machine: few men really trusted helicopters yet, and fewer still were prepared to entrust their lives to it. McConnell had no choice: his F-86E Sabre (51-2753), *Beauteous Butch*, had been riddled with 37-mm cannon fire from a MiG; smoke was seeping up into his cockpit; and his wingman was shouting at him about a long tongue of fire shooting from his exhaust and telling him to punch out. He might reach the helicopter, a few miles south of the bitterly-contested Yalu river battle zone known as MiG Alley: he might reach the chopper, but he would never get home.

Successful lift

Twenty minutes later, after a harrowing ejection, McConnell was being dragged through freezing-cold water, then lifted aloft, in a yoke dropped by the H-19. He lived to fight again. He was extraordinarily lucky. Air rescue with any chopper, under any conditions, was a new and outlandish notion in those days. Few remember, now, the terrible clatter or violent shaking of those early rotary-wing craft. Few remember that communication was difficult, that the mere act of finding a man to be rescued took brash, 'seat of the pants' flying.

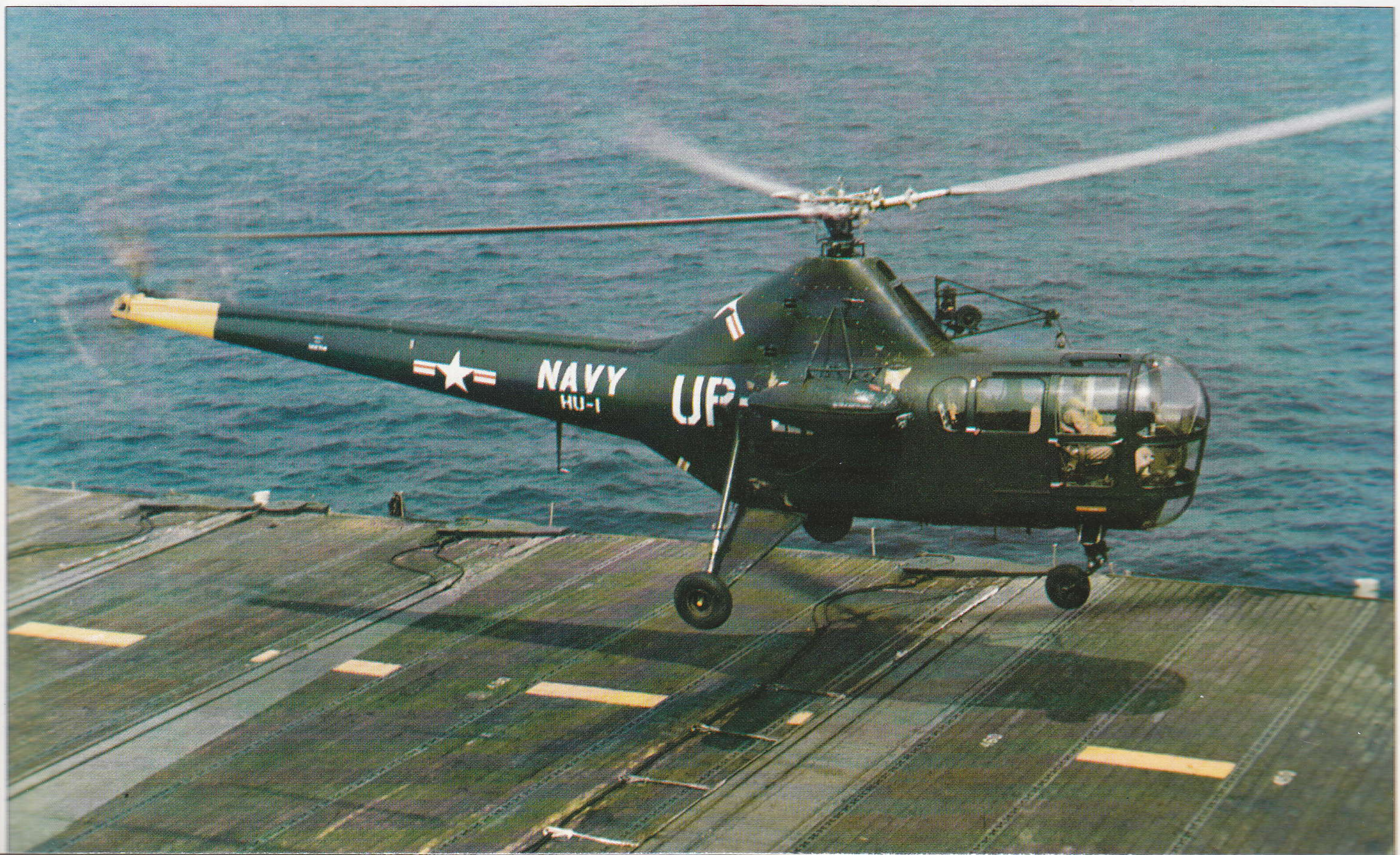
The very idea of accomplishing air rescue with a whirlybird (a popular term in the 1950s) was new and far from fully accepted. The US Air Force's rescue mission had been centralized in the late 1940s under the Air Rescue Service (ARS), headquartered at Scott Field, Illinois, and a slogan boldly proclaimed the ARS hope 'that others may live'. But ARS was equipped with the Grumman SA-16 Albatross, Boeing SB-17 Flying Fortress, Boeing SB-29 Superfortress and other fixed-wing types, all designed to airdrop supplies, food, medical gear and rafts, and expected to loiter overhead until vessels or ground parties could reach the victim. Fixed-wing aircraft provided the range and endurance to fly long rescue missions, and the SA-16 could land on water to take aboard the sick, the stranded and the shot-down. Helicopters vibrated furiously, guzzled fuel, often suffered radio failure, and lacked the 'staying power' to carry out a long, difficult search and rescue (SAR) operation. As recently as a few days before the 25 June 1950 outbreak of Korean fighting, Congress was scrutinizing proposed USAF helicopter purchases with a critical eye. One legislator is quoted as saying 'It doesn't have wings!'.

Igor Sikorsky piloted the first American helicopter, the VS-300, in 1939. A few Sikorsky R-4s, fragile craft with barely room for a passenger, and nicknamed Hoverfly, arrived in Burma before VJ-Day. The first actual rescue using a hoist was achieved on 29 November 1945 when an oil barge with two seamen broke loose in heavy seas near the Sikorsky plant at Bridgeport, Connecticut. Company test pilot Dimitry 'Jimmy' Viner, flying an R-5D (43-46642) in 105-km/h (65-mph) winds, pulled both seamen to safety. The R-4 (later H-4) and R-5 (H-5), the latter being Sikorsky's S-51 and the US Navy's HO2S/HO3S, were the real pioneers of air rescue in the days before the arrival of the H-19. The first rescue from a carrier at sea took place on 2 November 1948, when a Grumman F8F Bearcat pilot from the USS *Leyte* (CV-32) went into the drink and was plucked up by Ensign Robert Lynch in an HO3S-1 of squadron HU-2.

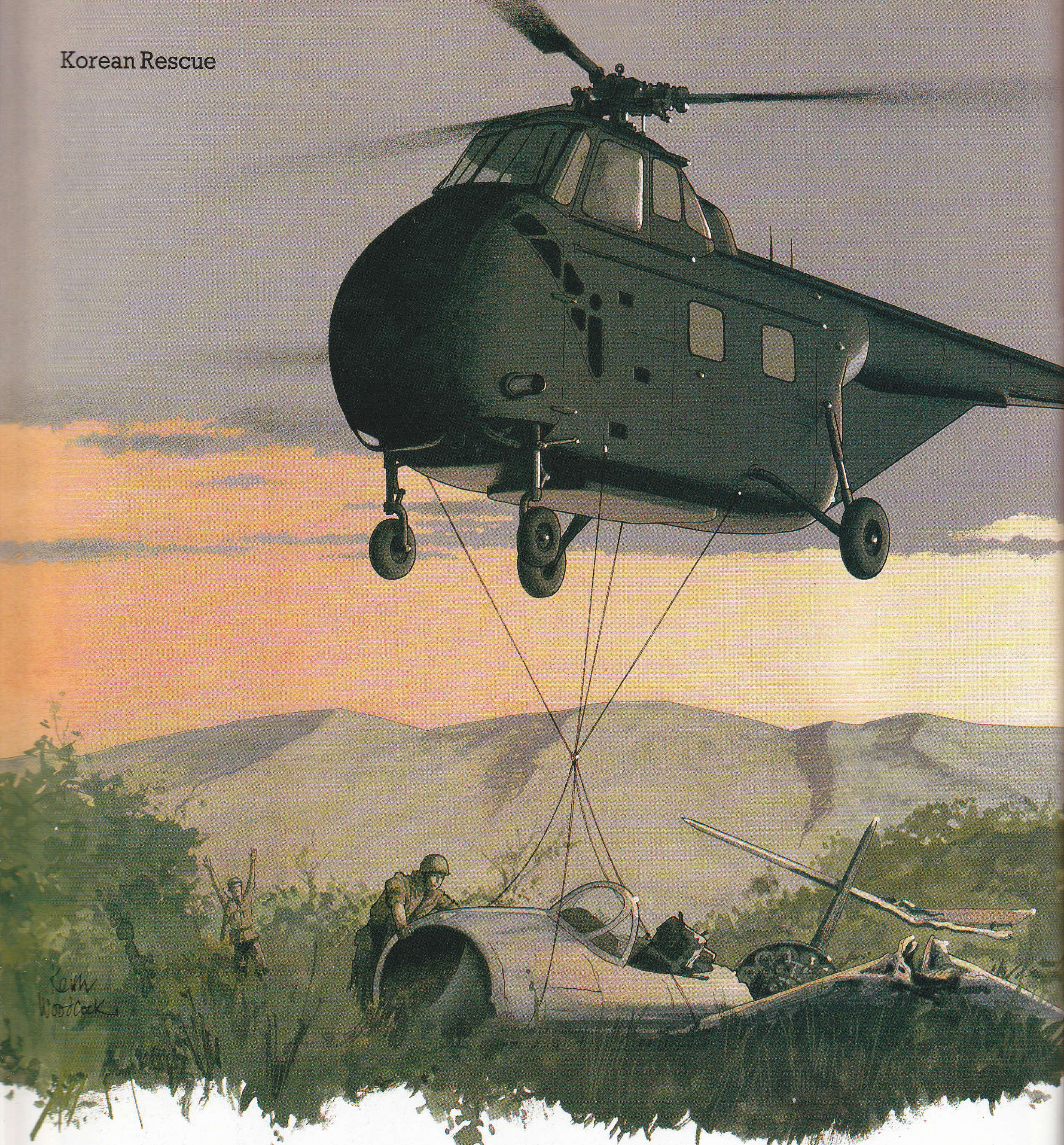
The H-5/HO3S-1 (built in the UK as the Westland Dragonfly) was the principal helicopter available to the US Army, US Air Force and US Navy in the early part of the Korean conflict. Powered by a 600-hp (447.4-kW) Pratt & Whitney R-1340 reciprocating engine driving three-blade main and tail rotors, the 48-ft (14.6-m) Sikorky H-5 barely had room for an extra crewman to operate its hoist. Its slim, narrow fuselage had no space for the person being rescued, so external litters were fitted. It was extremely vulnerable to North Korean small-arms fire. The H-5/HO3S-1 is best remembered by millions who watched Mickey Rooney die in a hail of gunfire trying to rescue William Holden in the Korean War film based on James Michener's *The Bridges at Toko-ri*.

US Navy helicopter rescue

A real-life Rooney, Lieutenant (JG) Charles Jones of squadron HU-1, was hit by small-arms fire in an HO3S-1 near Sariwon, North Korea, on 23 August 1950. His aircraft leaking fuel and hydraulics, Jones miraculously nursed the chopper 160 km (100 miles) south before ditch-

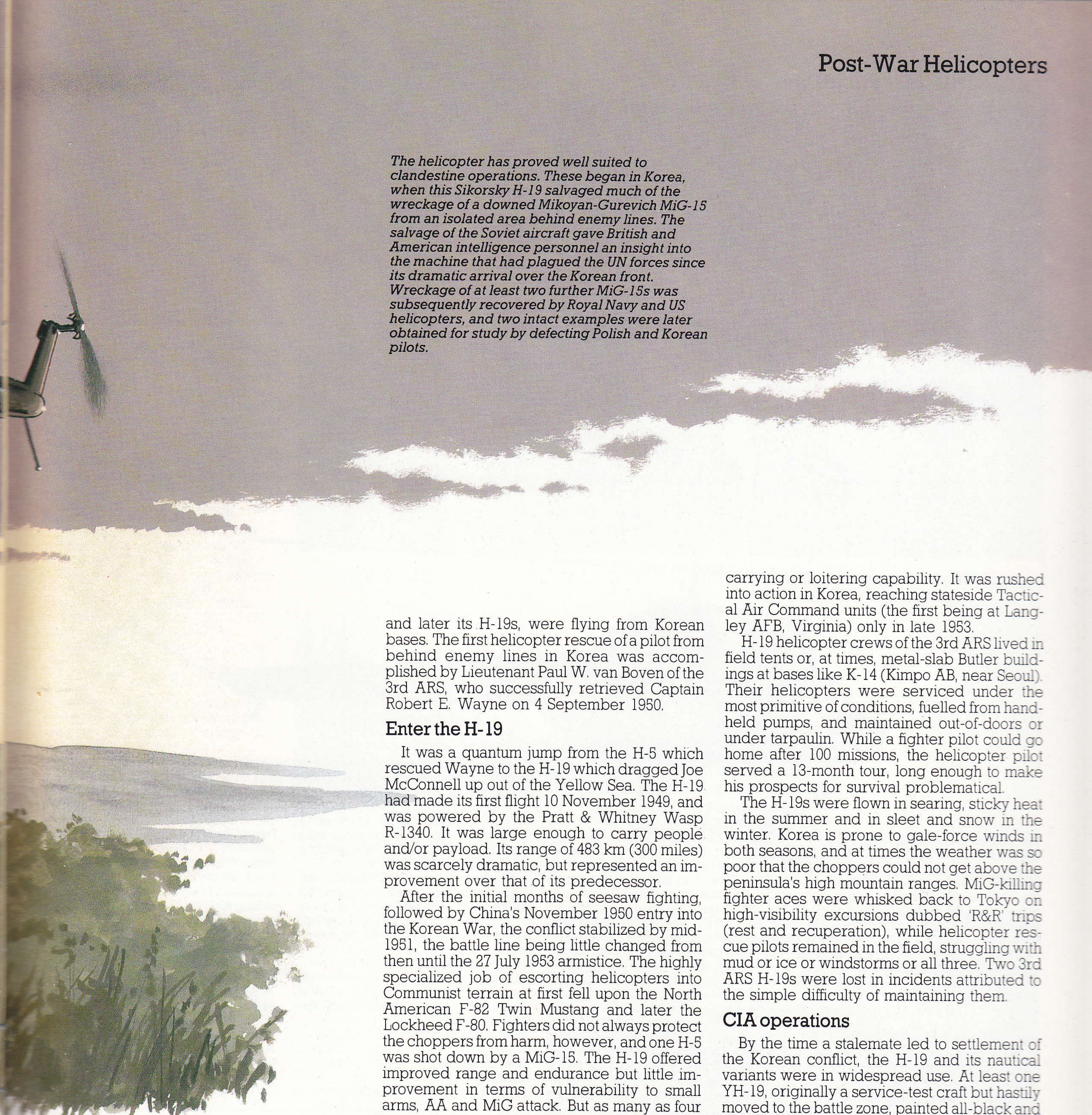


The Sikorsky R-5 made the first rescue using a hoist off the US coast in 1945, and the Navy's HO3S-1s, like this model seen here, were involved in the first rescue operations in Korea. Although the US Navy's carrier-based HO3S-1s were withdrawn in January 1951 and replaced by Piasecki HUPs, some continued to work from other Navy vessels.



ing in the Han river, the first loss of a rescue helicopter in the conflict. A shipmate, Lieutenant John Thornton, shot down in another HO3S-1 months later, became a prisoner of war for two and a half years. Though the US Navy's carrier-based HO3S-1 were replaced in January 1951 by the Piasecki HUP-1, some continued to operate from other US Navy surface vessels.

Not wishing to share actor Rooney's film fate, helicopter crews were happiest when the stricken pilot of a Grumman Panther, McDonnell Banshee or Douglas Skyraider could get clear of the heavily-defended enemy land mass and ditch at sea. Even then, the rescuer took a terrible risk. If the man in the water was incapacitated, and that took only moments in the Yellow Sea, the helicopter crewman had to leap into the water to put the pilot in the sling. Airman John Crawford did just that for Lieutenant (JG) John Abbot on 22 January 1952, knowing that he would have to wait in icy water within range of small-arms fire and hope his pilot could deposit Abbot on a nearby ship,



The helicopter has proved well suited to clandestine operations. These began in Korea, when this Sikorsky H-19 salvaged much of the wreckage of a downed Mikoyan-Gurevich MiG-15 from an isolated area behind enemy lines. The salvage of the Soviet aircraft gave British and American intelligence personnel an insight into the machine that had plagued the UN forces since its dramatic arrival over the Korean front. Wreckage of at least two further MiG-15s was subsequently recovered by Royal Navy and US helicopters, and two intact examples were later obtained for study by defecting Polish and Korean pilots.

return, and find him before he froze to death. This took 30 minutes and earned Crawford the second-highest American award for valour, the Navy Cross.

The US Navy's achievements notwithstanding, it was the US Air Force which racked up the first helicopter combat rescue. The 3rd Air Rescue Squadron had moved from Hickam AFB, Hawaii, to Johnson AB, Japan, when the guns began to shoot. Soon the squadron's H-5s, and later its H-19s, were flying from Korean bases. The first helicopter rescue of a pilot from behind enemy lines in Korea was accomplished by Lieutenant Paul W. van Boven of the 3rd ARS, who successfully retrieved Captain Robert E. Wayne on 4 September 1950.

Enter the H-19

It was a quantum jump from the H-5 which rescued Wayne to the H-19 which dragged Joe McConnell up out of the Yellow Sea. The H-19 had made its first flight 10 November 1949, and was powered by the Pratt & Whitney Wasp R-1340. It was large enough to carry people and/or payload. Its range of 483 km (300 miles) was scarcely dramatic, but represented an improvement over that of its predecessor.

After the initial months of seesaw fighting, followed by China's November 1950 entry into the Korean War, the conflict stabilized by mid-1951, the battle line being little changed from then until the 27 July 1953 armistice. The highly specialized job of escorting helicopters into Communist terrain at first fell upon the North American F-82 Twin Mustang and later the Lockheed F-80. Fighters did not always protect the choppers from harm, however, and one H-5 was shot down by a MiG-15. The H-19 offered improved range and endurance but little improvement in terms of vulnerability to small arms, AA and MiG attack. But as many as four rescued airmen could be hoisted aboard an H-19 and a little-known fact is that some of them could shoot back. Commander Howard Wheeler, an expert on armed helicopters, notes that the H-19 was the first chopper to carry a door-mounted 12.7-mm (0.5-in) gun.

Sikorsky's rather ungainly H-19 (the civilian S-55, US Navy HO4S-1 and US Marine Corps HRS-1, and later manufactured in the UK as the Westland Whirlwind) saved 13 downed airmen in the 1950-3 Korean struggle and performed various roles other than rescue for the US Army and US Marines. It may have been the first genuinely practical military helicopter. It was certainly the first with any significant load-carrying or loitering capability. It was rushed into action in Korea, reaching stateside Tactical Air Command units (the first being at Langley AFB, Virginia) only in late 1953.

H-19 helicopter crews of the 3rd ARS lived in field tents or, at times, metal-slab Butler buildings at bases like K-14 (Kimpo AB, near Seoul). Their helicopters were serviced under the most primitive of conditions, fuelled from hand-held pumps, and maintained out-of-doors or under tarpaulin. While a fighter pilot could go home after 100 missions, the helicopter pilot served a 13-month tour, long enough to make his prospects for survival problematical.

The H-19s were flown in searing, sticky heat in the summer and in sleet and snow in the winter. Korea is prone to gale-force winds in both seasons, and at times the weather was so poor that the choppers could not get above the peninsula's high mountain ranges. MiG-killing fighter aces were whisked back to Tokyo on high-visibility excursions dubbed 'R&R' trips (rest and recuperation), while helicopter rescue pilots remained in the field, struggling with mud or ice or windstorms or all three. Two 3rd ARS H-19s were lost in incidents attributed to the simple difficulty of maintaining them.

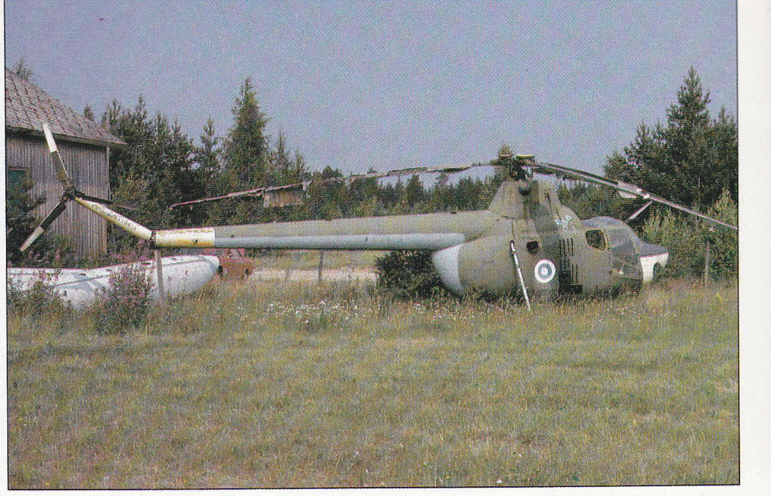
CIA operations

By the time a stalemate led to settlement of the Korean conflict, the H-19 and its nautical variants were in widespread use. At least one YH-19, originally a service-test craft but hastily moved to the battle zone, painted all-black and devoid of insignia, was used in CIA behind-the-lines operations. The US Navy HO4S-1 and US Marine HRS-1 were in widespread use by the time of the 1953 armistice and were later used to transport negotiators to the truce site at Panmunjom.

The earlier H-5 inspired Soviet imitators who produced a copy, the Yakovlev Yak-100, which turned out to be unsuccessful. Barely had the shooting stopped in Korea when several US Air Force H-19s were turned over to French forces in Indo-China. One decade and one war later, a handful of H-19s was still being used by the South Vietnamese air force at the beginning of the American involvement in that country.

USSR

Mil Mi-1 'Hare'



A semi-derelict example of the Mil Mi-1 'Hare' is shown in Finnish markings. The 'Hare' was a very good first-generation helicopter but cried out for further development and a turbine powerplant. The design was updated to become the Mil Mi-2.

By 1947 it had become clear to the Soviet leadership that helicopters would be necessary for many military and civil tasks, and a specification for a three-seat general-purpose helicopter was issued. One of three design bureaux asked to produce helicopter designs was that of Mikhail L. Mil, whose last previous design had been the A-15 autogyro of 1938. The first prototype, designated **GM-1**, flew in autumn 1948 and was the first Soviet production helicopter of the classic single-rotor layout. It was selected for production over the twin-rotor Bratukhin competitor and single-rotor Yakovlev Yak-100. The Soviet air force demonstrated the type for the first time in 1951 as the **Mil Mi-1T**, given the NATO reporting name **'Hare'**.

Float-equipped (**Mi-1P**) and trainer (**Mi-1U**) versions of the basic Mi-1T were produced in quantity, in addition to Soviet air force and navy co-operation and liaison aircraft. The overhaul life of critical components such as the transmission and rotor head was substantially improved during the production run, from 100 hours in 1951, to 500-600 hours in 1956, and to 1,000 hours in 1960.

The Mi-1 also started the record-breaking tradition which has typified Soviet helicopter development, setting up a variety of class records in the late 1950s. Long-distance records of up to 1224 km (761 miles) were set, as well as a speed of 141.2 km/h (87.7 mph) in a 1000-km (621-mile) closed circuit.

Production of the Mi-1 in the Soviet Union tailed off in 1956-8, being gradually transferred to the Polish state aircraft factory WSK-Swidnik. Both the airframe and engine were licence-built in Poland, WSK-manufactured aircraft being designated **SM-1**. About 150 SM-1s were deliverd to the Soviet Union, and manufacture of the type paved the way for Polish production of the later Mi-2.

Specification
Mil Mi-1

Type: utility and training helicopter

Powerplant: one 428.8-kW (575-hp) Ivchenko AI-26V radial piston engine

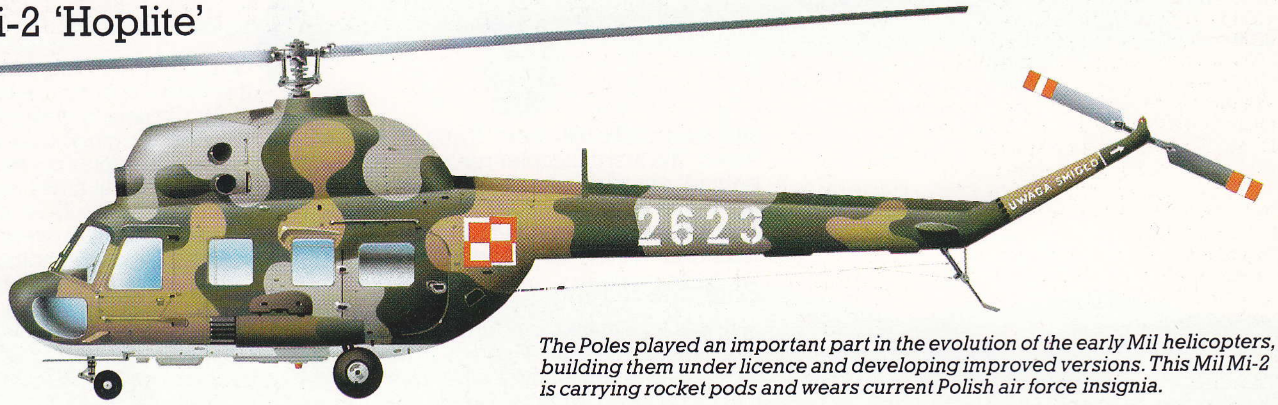
Performance: maximum speed 205 km/h (127 mph); cruising speed 140 km/h (87 mph); hovering ceiling 2000 m (6,562 ft); range 590 km (367 miles)

Weights: empty 1760 kg (3,880 lb); normal loaded 2400 kg (5,291 lb); maximum take-off 2550 kg (5,622 lb)

Dimensions: main rotor diameter 14.346 m (47 ft 0.8 in); fuselage length 12.00 m (39 ft 4.4 in); height 3.30 m (10 ft 9.9 in); main rotor disc area 161.64 m^2 (1,739.9 sq ft)

USSR

Mil Mi-2 'Hoplite'



The Poles played an important part in the evolution of the early Mil helicopters, building them under licence and developing improved versions. This Mil Mi-2 is carrying rocket pods and wears current Polish air force insignia.

The **Mil Mi-2 'Hoplite'** was developed in the early 1960s by the Mil bureau as a straightforward turbine-powered version of the Mi-1, the availability of the shaft-turbine engine having revolutionized the design of the helicopter. The twin turbines develop 50 per cent more power than the Mi-1's piston engine for barely half the dry weight, more than doubling the payload. The fuselage of the Mi-2 is completely different from that of its progenitor, carrying the engines above the cabin. Although some of the points of commonality between the Mi-1 and the Mi-2 were eliminated during development, the overall dimensions of the two types remain closely similar.

The Mi-2 was flown in 1962, but never put into production in the Soviet Union. Instead responsibility for the type was assigned to PZL-WSK-Swidnik now in Poland as part of a Comecon rationalization programme, becoming the only Soviet-designed helicopter to be built solely outside the Soviet Union. Production in Poland started in 1965, and continues in the mid-1980s.

The Mi-2 is now the standard training helicopter of the Soviet Union, and has also been seen armed with anti-tank guided weapons. Its role, however, may be as a weapons trainer rather than an attack helicopter, as its slow speed and relatively old-technology rotor system (which limits its manoeuvrability for low-level 'nap-of-the-earth' flying) would render it vulnerable to NATO defences. It is therefore more likely that pilots and weapon operators learn their skills on the Mi-2 before proceeding to the Mi-24 'Hind'.

PZL has developed a slightly enlarged version of the Mi-2, designated **Mi-2M**, but this 10-seat aircraft appears to be aimed mainly at the civil market. A reported version with a lighter skid landing gear (the only use of such a feature on a recent Warsaw Pact helicopter) has not been proceeded with, but efforts have been made to sell a US-engined version of the Mi-2 in the United States.

Specification
Mil Mi-2

Type: eight-passenger transport, attack and training helicopter

Powerplant: two 321.4-kW (431-shp) Isotov GTD-350 turboshafts

Performance: maximum speed at sea level 210 km/h (130 mph); cruising speed 190 km/h (118 mph); service ceiling 4000 m (13,123 ft); maximum range 590 km (367 miles); range with eight passengers 240 km (149 miles)

Weights: empty 2402 kg (5,296 lb); maximum take-off 3700 kg (8,157 lb)

Dimensions: main rotor diameter 14.56 m (47 ft 9.2 in); fuselage length 11.94 m (39 ft 2.1 in); height 3.75 m (12 ft 3.6 in); main rotor disc area 166.5 m^2 (1,792.25 sq ft)

Armament: up to four AT-3 'Sagger' (possibly AT-5) anti-tank guided weapons or a combination of rocket pods and gun pods

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USSR

Mil Mi-4 'Hound'

Developed to flight-test status in only seven months following a personal edict from Stalin, the **Mil Mi-4 'Hound'** was at first considered to be a Soviet copy of the Sikorsky S-55 until it was realized that it was considerably larger than the later S-58. It was thus the first of a long line of large Mil helicopters.

The first prototype Mi-4 was completed in April 1952. It shared the basic layout of the S-55, with the powerful radial engine in the nose and quadricycle landing gear, but added a pair of clamshell loading doors capable of admitting a small military vehicle or most light infantry weapons such as anti-tank guns. It was thus a far more capable military transport than its Western contemporaries, and several thousand of the type were built.

The Mi-4 entered service in 1953. Early production aircraft had wooden-skinned rotor blades of very short life, but later aircraft had all-metal blades. Special versions include an amphibious development, tested in 1959, and the **Mi-4V** for high-altitude operations with a two-stage supercharger fitted to the ASh-82FN engine. The Mi-4 was also put into production at the Shenyang plant in China, as the **H-5**.

The Mi-4 has been one of the most important helicopters in service with the Soviet armed forces. At the 1956 Tushino air display, a formation of 36 Mi-4s demonstrated their ability to land a sizeable and well-equipped infantry force; later, the type became the Soviet Union's first armed helicopter, with a machine-gun in the nose of the navigator's gondola and rocket pods on outriggers from the fuselage. This version was introduced as an interim armed helicopter with the expansion of the Soviet tactical air forces in the late 1960s. More recently, Mi-4s have been equipped with prominent aerials for communications jamming equipment.

With the rise of the Soviet navy, the Mi-4 found another new role: a number

The Mil Mi-4, dubbed 'Hound' by NATO, was one of the world's largest helicopters when it entered service. It was built in enormous numbers and formed the backbone of the Warsaw Pact's helicopter forces for many years. It still serves in a number of roles with a variety of operators.

of the type were fitted with search radar beneath the nose and used as anti-submarine warfare aircraft in the Black Sea and Baltic areas. Other ASW equipment includes a magnetic anomaly detector (MAD) installed in a 'bird' towed behind the helicopter, and the type presumably also carries dunking sonar. The Mi-4 ASW variant paved the way for the later introduction of the Mi-14 'Haze'.

Specification

Mil Mi-4

Type: 12-seat transport and anti-submarine warfare helicopter

Powerplant: one 1267.7-kW (1,700-hp) Shvetsov ASh-82V two-row radial piston engine

Performance: maximum speed 210 km/h (130 mph); cruising speed 160 km/h (99 mph); service ceiling 6000 m (19,685 ft); hovering ceiling 2000 m (6,562 ft); normal range 590 km (367 miles)

Weights: empty 5390 kg (11,883 lb); maximum take-off 7800 kg (17,196 lb)

Dimensions: main rotor diameter 21.00 m (68 ft 10.8 in); fuselage length 16.79 m (55 ft 1 in); height 5.18 m (17 ft 0 in); main rotor disc area 346.36 m^2 (3,728.3 sq ft)

Armament: 7.62-mm (0.3-in) machine-gun in ventral gondola, and rocket or gun pods; (ASW) depth charges or torpedoes

The Mil Mi-4 has been produced as the Whirlwind H-25 or H-5. One has been fitted with a Pratt & Whitney Canada PT6 engine, but this version has not entered service. Chinese Mil Mi-4s are believed to have been used in action recently against Vietnam.

UK

Bristol Type 171 Sycamore

Late in 1944 the Bristol Aeroplane Company formed a Helicopter Department at Filton and recruited Raoul Hafner from the Airborne Forces Experimental Establishment, where he had been leading a British rotorcraft development team. Drawing on pre-war experience with his A.R.III Gyroplane, Hafner started work on a single-engine four-seat helicopter for both civil and military applications. The lack of a sufficiently developed British engine of the required power led to selection of the widely-used 335.6-kW (450-hp) Pratt & Whitney Wasp Junior for the first two **Bristol Type 171 Mk 1** prototypes, developed to Ministry of Supply Specification E.20/45.

The design featured a light alloy cabin section and a stressed-skin tailboom attached to a central engine and gearbox mounting, the rotor head being fitted with three wooden monocoque blades. After extensive component testing, ground running of the completed airframe began on 9 May 1947, and the first flight was made by H.A. Marsh on 27 July. The second aircraft joined the test programme in February 1948 and on 25 April 1949, to facilitate its flight to the Paris Salon, it became the first British helicopter to be granted a civil certificate of airworthiness. An Alvis Leonides radial was installed in the third airframe which appeared in the static park at the 1948 SBAC exhibition at Farnborough. Designated **Type 171 Mk 2**, this helicopter made a successful first flight on 3 September 1949, although a second take-off attempt ended abruptly when the rotor disintegrated. With a strengthened rotor, development flying was resumed while work continued on the assembly of 15 production **Type 171 Mk 3** helicopters.

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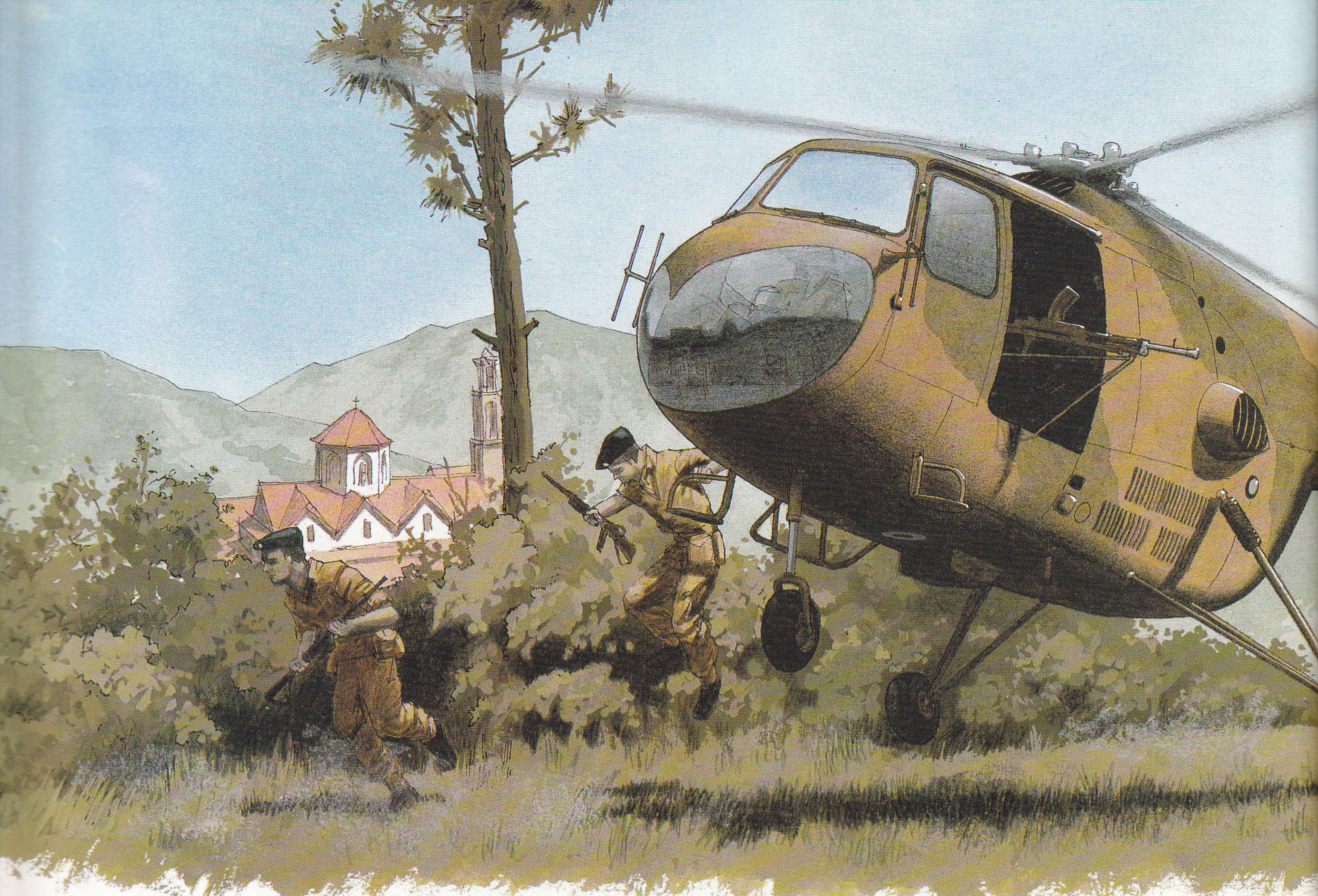
The Bristol Sycamore was underpowered, but its superbly-designed and well-balanced rotor system made it efficient and a joy to fly, despite its lack of autostabilization.



The Sycamore in Action

The Sycamore played a crucial role in Britain's operations against the EOKA terrorists, pioneering new mountain flying and helicopter assault techniques and specializing in swift cordon and search operations (sometimes using cabin-mounted machine-guns for defence suppression). The most spectacular mission was the one that resulted in the death of the EOKA chief of staff.

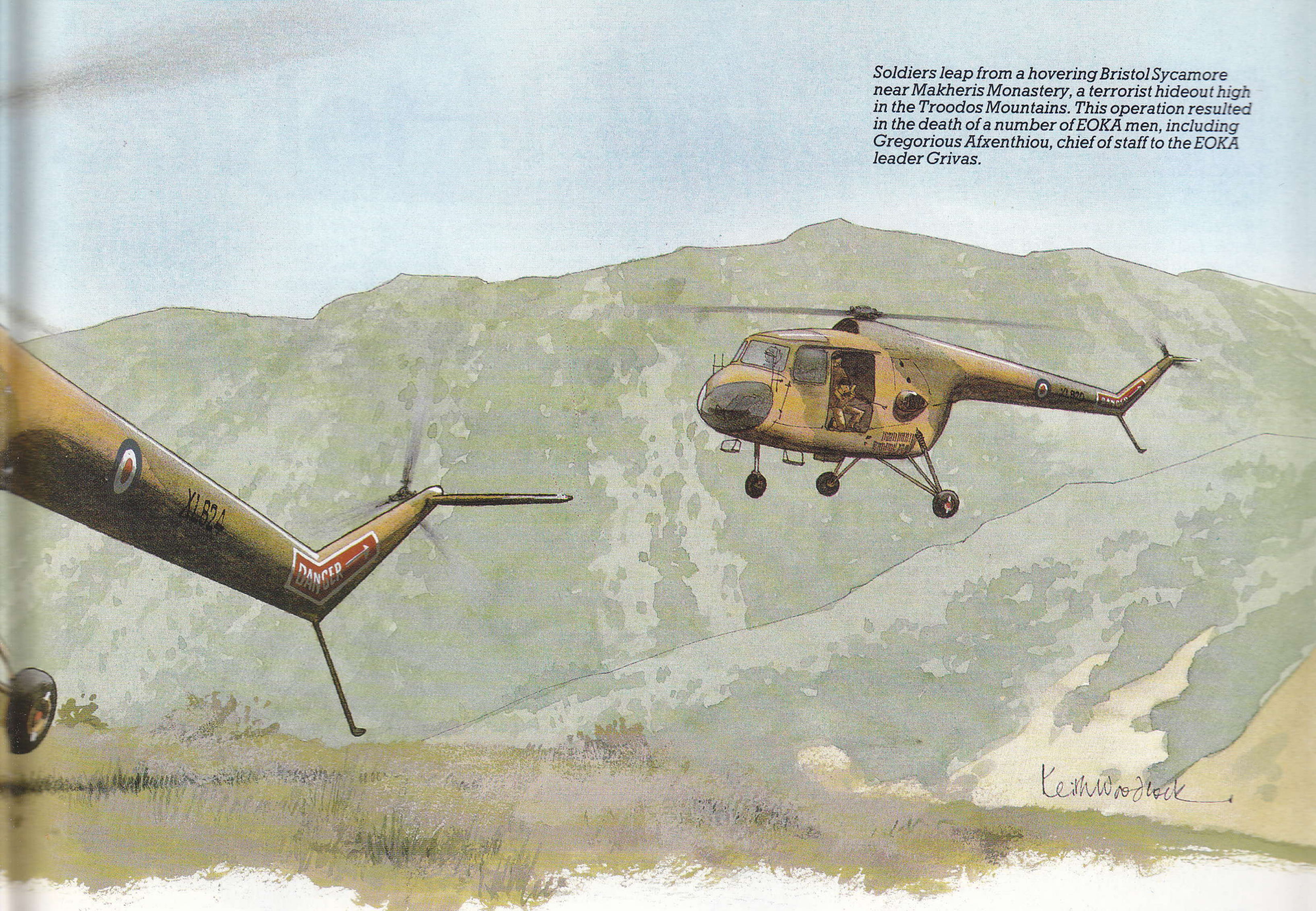
During the period after World War II the UK's military involvement overseas, especially in the ex-colonies, has provided much useful training for the British armed forces and has allowed 'operational' evaluation of equipment and tactics. During the 1950s the UK probably led the world in the development of helicopter operations as a result of experience in Malaya and the Middle East, although it relied largely on licence-built (and sometimes slightly-improved) American helicopters such as the Sikorsky S-51 (otherwise the Westland Dragonfly), Sikorsky S-55 (Westland Whirlwind) and Sikorsky S-58 (Westland Wessex).

The first wholly British designed helicopter to enter service with the Royal Air Force was the delightful Bristol Sycamore, a product of the helicopter pioneer Raoul Hafner. The Sycamore was a relatively small helicopter which could accommodate only three passengers in contrast with the 10 passengers of the early, piston-engine Whirlwind. In hot-and-high conditions, however, the early Whirlwinds were unable to compete, being unable to take-off with a useful load. The Sycamore was, by all accounts, a joy to fly and did not need the powered controls or autostabilization required by contemporary American designs. The Sycamore was used in the communications, search and rescue, assault and transport roles at home and overseas, and the final example was not retired until August 1972. The capabilities of the Sycamore are best seen by examining the aircraft's role in Cyprus, where the type played a major part in the war against EOKA, and in developing helicopter tactics.

The first Sycamores in Cyprus arrived in May 1955, and were intended for search and rescue duties. Initially the aircraft were not used with much imagination since the pilots assigned were inexperienced and staff officers woefully ignorant of the helicopter's tactical potential. The arrival of Sir John Harding as the governor of Cyprus was probably the turning point. As Chief of the Imperial General Staff, Harding had seen the advantages of helicopters and in Cyprus he encouraged their use and gave his support to the development of mountain flying techniques. By the end of 1955 the internal security situation had deteriorated and pressure had grown to use the helicopters in support of army operations. The first use of the Cyprus-based Sycamores in the internal security role occurred on 1 November 1955, when a Commando unit engaged in arms searches was transported into the Black Forest area of the Kyrenia mountains. The helicopters proved so successful that by the end of 1956 the Cyprus Search and Rescue Flight had 14 Sycamores on strength, 10 of them assigned to internal security duties.

In Cyprus there was little knowledge of the helicopter operations which were being conducted in Malaya, and many techniques had to be re-invented. Helicopter pilots in Cyprus faced different problems from those encountered in Malaya since troop deployments were usually to precipitous sites on mountains, where landing was impossible. The Sycamores were flown without doors to save weight and to permit rapid deployment of troops. Trials using a Whirlwind Mk 2 proved the superiority of the Sycamore at high altitudes, as were encountered in the Cypriot mountain ranges, and in October 1956 the Internal Security and Search and Rescue Flights became No. 284 Squadron, retaining the Sycamore as its equipment.

The anti-EOKA campaign peaked in early 1957, the Sycamores being intensively and imaginatively used. Initially the standard procedure was for troops to be dropped at remote observation posts with supplies for 48 hours. A larger force was prepared to be lifted in if necessary. Later the 'cordon and search' technique became more common, whereby firing



Soldiers leap from a hovering Bristol Sycamore near Makheris Monastery, a terrorist hideout high in the Troodos Mountains. This operation resulted in the death of a number of EOKA men, including Gregorious Afxenthiou, chief of staff to the EOKA leader Grivas.

parties dropped from individual helicopters sealed off villages while a pre-positioned main force arrived by road. A variation on this type of operation can be illustrated by the sealing off of the village of Kharch in the Kyrenian mountain range. Four Sycamores put a cordon of 12 troops around the village while three soldiers from another helicopter were put into Kharch to announce a curfew and undertake a search. The cordon was maintained for 45 minutes, during which a bus and civilians trying to leave were turned back.

Truce declared

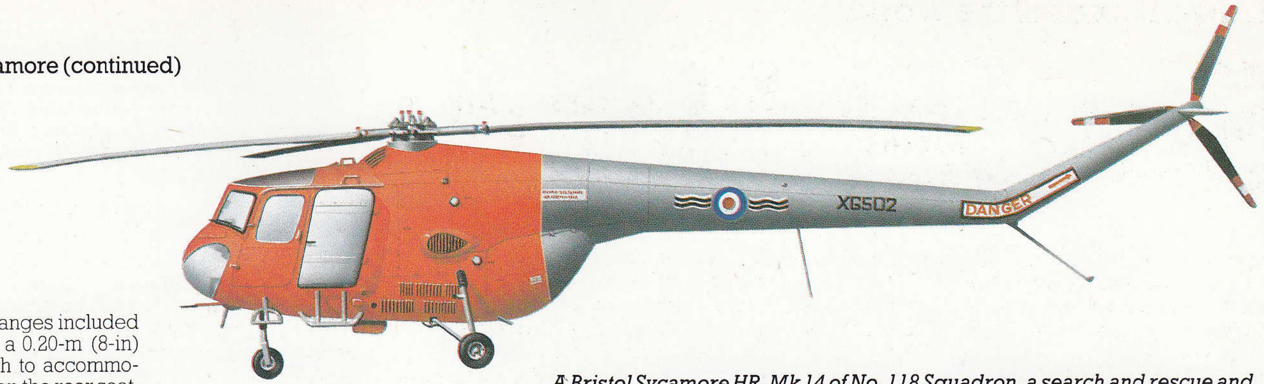
In April 1957 Archbishop Makarios returned from detention to Athens and EOKA declared a truce. No. 284 Squadron continued regular cordon and search operations to try and locate Grivas (the EOKA leader), his armed bands and their weapons. Between April 1956 and May 1957, the 10 No. 284 Squadron Sycamores committed to internal security duties flew 2,561 hours and delivered 3,436 troops 'in anger' while over 4,000 received training in helicopter-borne operations. Early in 1958 No. 284 Squadron's Sycamores flew perhaps their most spectacular sortie. Five Sycamores, equipped with cabin-mounted, side-firing Bren guns, ferried 41 troops to Makheris Monastery, a terrorist hide-away 915 m (3,000 ft) up in the Troodos range but only 32 km (20 miles) from Nicosia. The operation resulted in the deaths of a number of terrorists including Gregorios Afxenthiou, then chief of staff to Grivas.

The introduction of the British Partnership Plan for Cyprus on 1 October 1958 led to an intensification of EOKA violence, especially against civilians. This caused the Sycamores to fly an unprecedented number of casualty evacuation sorties until the squadron was supplemented by No. 230, flying Prestwick Pioneers, and by the Whirlwinds of the Joint Experimental Helicopter Unit. Even after this the Sycamores continued to fly intensively, eventually settling into peacetime activity after the London and Zurich conferences and the return to Cyprus of Makarios in March 1958.

ROYAL AIR FORCE

The first helicopters in Cyprus were the Sycamores of the Search and Rescue and Internal Security Flights. These were combined to form No. 284 Squadron which, after the emergency, became No. 103 Squadron. A winch-equipped Sycamore of the latter unit is seen here over St Hilarion Castle.

The campaign against EOKA would have been impossible without the Sycamore, which went on to fight in the Brunei campaign in Borneo with No. 110 Squadron.



A Bristol Sycamore HR. Mk 14 of No. 118 Squadron, a search and rescue and communications unit based in Northern Ireland. Unusually the aircraft carries squadron markings – black and white wavy lines inherited from the squadron's Hunters.

In these, airframe changes included a shortened nose and a 0.20-m (8-in) increase in cabin width to accommodate three passengers on the rear seat. In order to maintain essential systems in the event of engine failure, the accessory drive was transferred from the engine to the rotor gearbox. The initial production batch included one **Sycamore HC.Mk 10** and four **Sycamore HC.Mk 11** ambulance and communications machines for evaluation by the Army Air Corps, and four **Sycamore HR.Mk 12** helicopters for rescue duties with RAF Coastal Command. Two **Sycamore Mk 3A** helicopters, with a freight hold behind the engine bay, were built for British European Airways.

The main production was the **Type 177 Sycamore Mk 4**, incorporating modifications evolved from Mk 3 experience; these included taller landing gear, four cabin doors and the pilot's position moved from port to starboard. Deliveries included three **Sycamore HR.Mk 50** and seven **Sycamore HC.Mk 51** helicopters for the Royal Australian Navy, three **Sycamore Mk 14** aircraft for Belgian air force use in the Congo, and 50 **Sycamore Mk 52** helicopters for the Federal German army and navy; the Royal Air Force received two **Sycamore HR.Mk 13** and more than 80 **Sycamore HR.Mk 14** helicopters equipped with winches for air-sea rescue duties, initially with No. 275 Squadron, Fighter Command, which received its first helicopter on 13 April 1953. Sycamores also operated in the light assault and reconnaissance roles in Malaya, Cyprus and Borneo.

Specification

Sycamore HR.Mk 14

Type: five-seat communications/SAR/ light troop-carrying helicopter

Powerplant: one 410.1-kW (550-hp) Alvis Leonides 73 radial piston engine

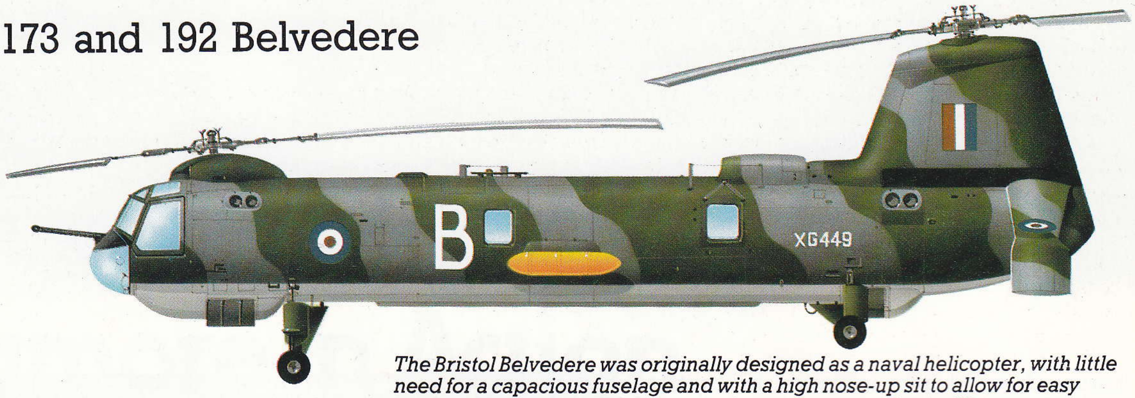
Performance: maximum speed 204 km/h (127 mph) at sea level; cruising speed 169 km/h (105 mph); endurance 3 hours

Weights: empty 1728 kg (3,810 lb); maximum take-off 2540 kg (5,600 lb)

Dimensions: main rotor diameter 14.81 m (48 ft 7 in); length, rotors folded 14.07 m (46 ft 2 in); height 3.71 m (12 ft 2 in); main rotor disc area 172.22 m^2 (1,853.8 sq ft)

UK

Bristol Types 173 and 192 Belvedere



The Bristol Belvedere was originally designed as a naval helicopter, with little need for a capacious fuselage and with a high nose-up sit to allow for easy loading of a torpedo. The Navy requirement was met by the Wessex.

The first British tandem-rotor helicopter, the **Bristol Type 173** combined two sets of Sycamore rotors and control systems, each powered by a 428.8-kW (575-hp) Alvis Leonides engine. These were each arranged to drive through a freewheel clutch so that, with both rotor gearboxes interconnected by a shaft, either engine could drive both rotors in the event of an engine failure.

The first of two prototypes, developed to Ministry of Supply Specification E.4/47, made its first hovering flight on 3 January 1952, flown by C.T.D. Hosegood, but ground resonance problems delayed further progress until July. The first flight from the airfield at Filton took place on 24 August, and this **Type 173 Mk 1** helicopter appeared at the SBAC show in September. RAF evaluation followed, and in 1953 naval trials were undertaken aboard the aircraft-carrier HMS *Eagle*.

The second prototype, designated **Type 173 Mk 2**, was first flown on 31 August 1953 and was transferred to the Royal Air Force in August 1954 for further naval trials.

Three more prototypes, designated **Type 173 Mk 3**, were built for the Ministry of Supply, having 633.8-kW (850-hp) Leonides Major engines, four-blade metal rotors and a taller rear pylon. Only the first progressed beyond the ground-running stage, beginning hovering trials on 9 November 1956. The third had the shortened fuselage and long-stroke landing gear of the **Type 191** naval version.

The Royal Air Force had a requirement for a personnel and paratroop transport and casevac helicopter, also capable of lifting bulky loads on an external sling. An order for 22 of the **Type 192** version was placed in April 1956, later increased to 26, all to be Napier Gazelle-powered. The prototype, first flown at Weston-super-Mare on 5 July 1958, was joined in the development programme by nine pre-production aircraft. These originally had wooden rotor blades, and tailplanes with anhedral and end-plate fins; they were later brought up to production standard for delivery to the RAF. Modifications included the substitution of metal rotor blades and compound anhedral tailplanes, the provision of powered flying controls, sliding doors, improved air inlets and enlarged low-pressure tyres. The eleventh aircraft was completed by Westland as the first **Belvedere HC.Mk 1**, delivered to No. 66 Squadron at RAF Odiham in August 1961. This unit was also the last to operate Belvederes, disbanding at RAF Seletar in March 1969.

Specification

Bristol (Westland) Belvedere HC.Mk 1

Type: short-range tactical transport

Powerplant: two 1092.5-kW (1,465-shp) Napier Gazelle NGa.2 turboshafts

Performance: maximum cruising speed 222 km/h (138 mph); service ceiling 5275 m (17,300 ft); range with payload of 2722 kg (6,000 lb) 121 km (75 miles); ferry range 740 km (460 miles)

Weights: empty 5277 kg (11,634 lb); maximum overload take-off 9072 kg (20,000 lb)

Dimensions: rotor diameter, each 14.91 m (48 ft 11 in); length, rotors turning 27.36 m (89 ft 9 in); height 5.26 m (17 ft 3 in); rotor disc area, total 349.18 m^2 (3,758.7 sq ft)

The Belvedere had a superbly designed rotor system, and the prototypes could be flown without autostabilization. The engine and gearbox arrangement allowed for a safe landing to be made in the event of either engine or synchronizing shaft failure and the aircraft proved pleasant to fly. It was maintenance-intensive and performed poorly in Aden with No. 26 Squadron, although their record in Malaya was good due to better maintenance.

Soviet Navy

Part 1

During the past 20 years or so the Soviet navy has, under the guidance of Admiral of the Fleet of the Soviet Union Sergei Gorshkov, evolved into a service that is now capable of worldwide operations in direct support of the combined political and strategic aims of the Soviet state.

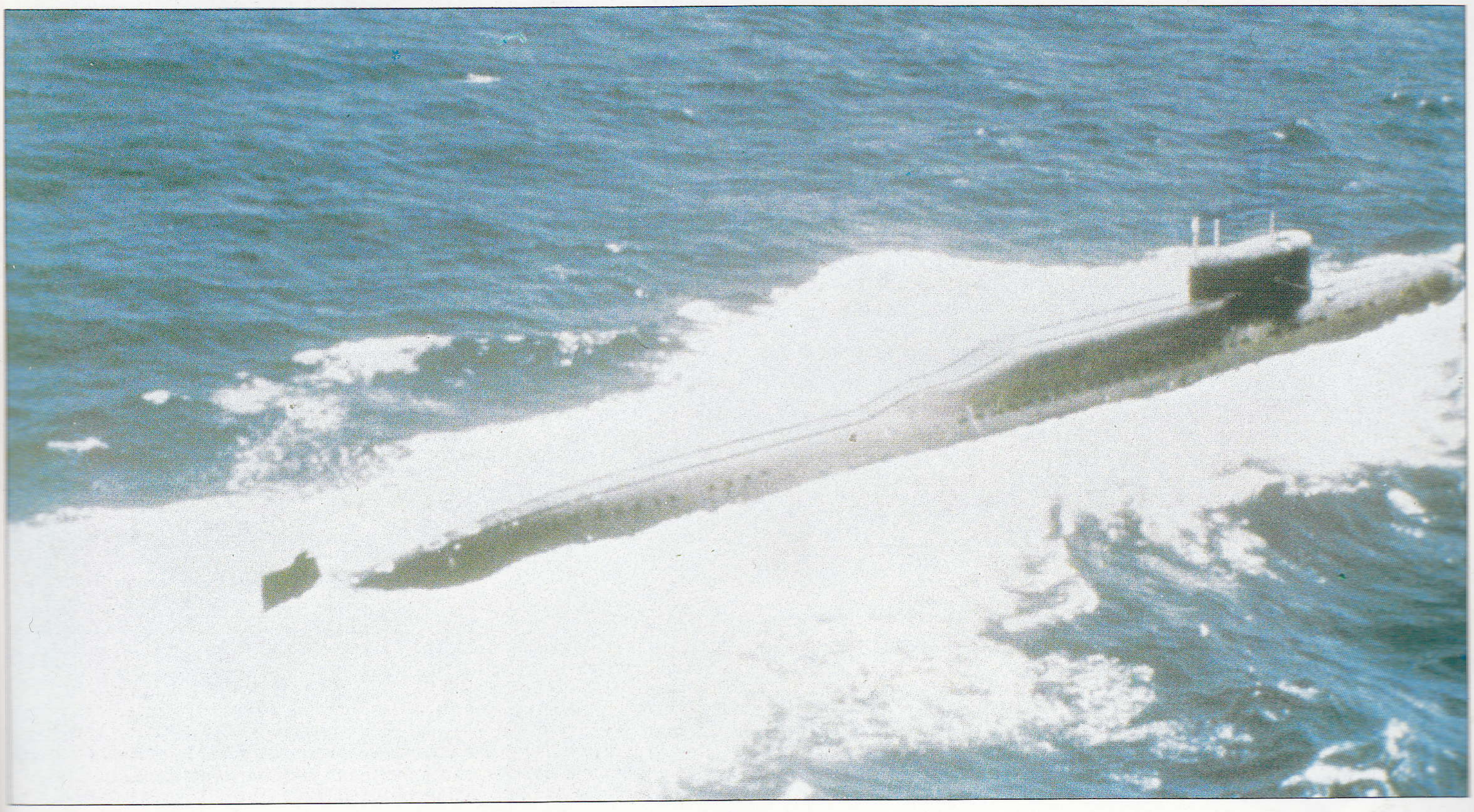
For geographical reasons the navy has perforce been divided into four separate fleets. Of these the Northern Fleet, as the primary component of the Arctic Command, is the most important. The fleet's headquarters and main operational base is Severomorsk, with other bases at Gremikha, Polyarny, Archangelsk and on the Motovskiy Gulf. The majority of the SSBN fleet is assigned to this area, together with a significant proportion of the Soviet naval air force. For land operations and special missions a naval infantry regiment and a *spetsnaz* special forces brigade are also allocated. Some eight to 10 of the fleet's conventional and nuclear attack and cruise-missile submarines are assigned to the Soviet Mediterranean Squadron at any one time. In wartime the fleet's main operating areas would be the Greenland-Iceland-United Kingdom (GIUK) Gap, northern Norway and, for the submarine force, the whole of the North Atlantic and its contiguous seas.

There is also an Atlantic Command, but this in fact comprises the Baltic and Black Sea Fleets. The former has its headquarters at Baltiysk, with other major bases at Kronshtadt, Paldiski, Liepaja, Klaipeda and Riga. There are few if any nuclear submarines assigned to the Baltic Fleet, as its primary role in wartime within the enclosed and relatively shallow Baltic Sea area is to support the Soviet army's flank during any advance along the Baltic coastline and to eliminate or capture strategic NATO coastal positions, islands and natural 'choke-points'. The Baltic Fleet's long-range missile-carrying aircraft will also attack naval targets in the English Channel and North Sea, and on occasion lay anti-shipping ground mines and bomb targets ashore as far west as the United Kingdom and the Brest peninsula of France. Like the Northern Fleet, the Baltic Fleet has a naval infantry regiment and a *spetsnaz* brigade. The latter has been particularly active in recent years with its squadron of midget submarines operating in Swedish territorial waters in 'realistic' training missions.

The Black Sea Fleet, which includes the small flotilla confronting Iran on the land-locked Caspian Sea, has its headquarters at Sevastopol, with other major bases at Balaklava, Poti and Odessa. This fleet provides the majority of the surface vessels, including at least one 'Moskva' class helicopter carrier, assigned to the Mediterranean Squadron. It has no assigned nuclear submarines, and in war its primary mission will be to attack targets on the Turkish Black Sea coast and to seize the Dardanelles so as to provide free access for Soviet naval units into the Mediterranean. The naval air force units will also launch air attacks against NATO surface ships and reinforcement convoys located in the eastern half of the Mediterranean as part of the overall strike plan co-ordinated by the Soviet Naval Main Headquarters near Moscow.

Because of the growing importance of the Pacific Fleet in strategic plans, there has been a significant transfer of reinforcements to the region from the other three fleets, as well as a programme of new vessels built in the shipyards of the Soviet Far East. The main base and headquarters are at the old tsarist port of Vladivostok, with other major bases at Petropavlovsk-Kamchatskiy and Sovetskaya Gavan. Detachments of surface ships and submarines can also be seen forward-deployed throughout the year in the Indian Ocean and South China Sea. On such deployments the vessels regularly use the Soviets' maintenance, repair and resupply facilities in Vietnam (at the ex-US base of Cam Ranh Bay), South Yemen (at Socotra and Aden) and Ethiopia (the Dahlak Islands, which replaced a base in Somalia). These bases are also visited by Pacific Fleet aircraft and, on occasion, by Black Sea Fleet air units on long-range reconnaissance and training flights. Because of the close proximity of Japan, South Korea and the People's Republic of China to the Pacific Fleet's bases and their wealth of decisive targets, a divisional-sized force of two naval infantry regiments with support units is assigned to the fleet's amphibious warfare ships. There is also the obligatory *spetsnaz* brigade for the covert operations and, as in the large Northern Fleet, this is backed by a number of smaller independent units which have received highly specialized training in the fields of parachuting, underwater demolition and assassination. It is interesting to note that the Soviet army hierarchy considers this naval infantry division to be equivalent in operational capabilities to two motorized rifle divisions.

The main striking force of the Soviet Navy is, however, its force of strategic missile submarines. These are a major component of the total Soviet nuclear-warfare capabilities, and provide an assured 'second-strike' force under which Soviet politico-military actions at lower levels can be conducted. By late 1984 the force comprised two 'Typhoon' class (each with 20 SS-N-20 SLBMs) plus more boats building, 14 'Delta III' class (each with 16 SS-N-18



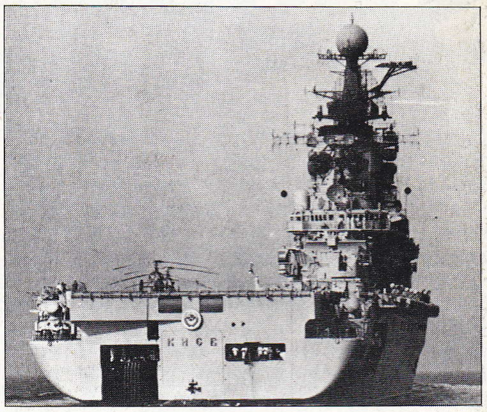
The Soviet navy's 18 'Delta I' class SSBNs are armed with 12 SS-N-8 SLBMs, and are deployed with both the Northern and Pacific Fleets. They can, from the safety of 'bastion' areas off the Soviet coastlines, hit targets in the continental United States.

SLBMs), plus more submarines building, four 'Delta II' class (each with 16 SS-N-8 SLBMs), 18 'Delta I' class (each with 12 SS-N-8 SLBMs), one 'Yankee II' class (with 12 SS-N-17 SLBMs) and 23 'Yankee I' class (each with 16 SS-N-6 SLBMs), all second- and third-generations SSBNs, with only two 'Hotel II' (each with three SS-N-5 SLBMs) and a converted 'Hotel III' class (with six SS-N-8 SLBMs) trials vessel left of the first-generation SSBNs. To assist these primary forces, 13 'Golf II' class (each with three SS-N-5 SLBMs) and a solitary 'Golf III' class (with six SS-N-8 SLBMs) conventionally-powered SSBs remain in operation. Of these, six of the 'Golf IIs' are with the Baltic Fleet, six are with the Pacific Fleet and the remaining one is with the Northern Fleet. All are assigned to the theatre nuclear strike role with their 800-kiloton warhead equipped SS-N-5s, as are the single obsolete 'Hotel II' SSBN units serving in the Northern and Pacific Fleets. The two missile research and development platforms, the 'Hotel III' and the 'Golf III' units, are in the Northern Fleet and are believed to have a limited wartime intercontinental role.

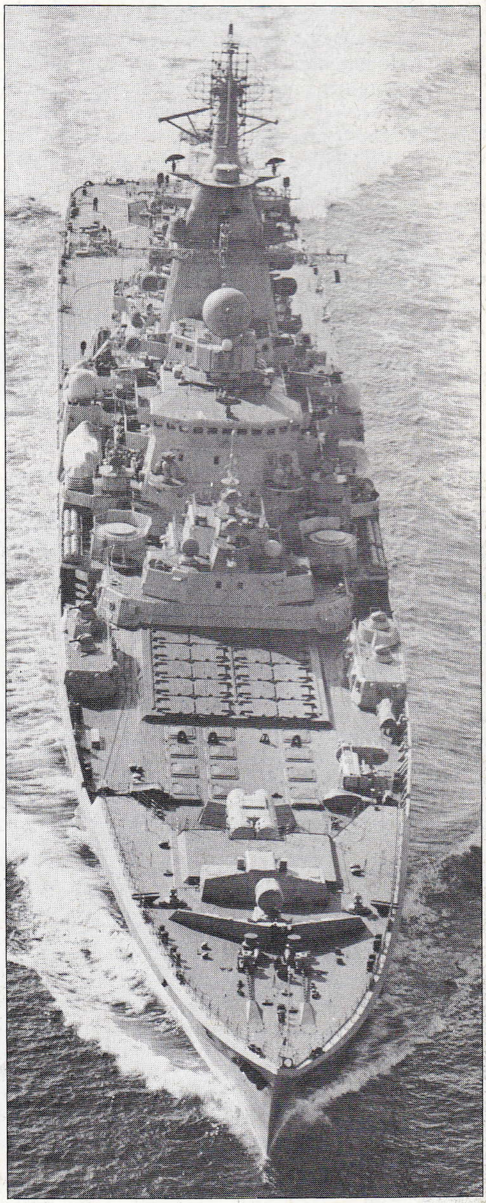
Of the modern craft the Northern Fleet has the lion's share, with the two 'Typhoons', 17 'Delta Is' and 'Delta IIIs', the four 'Delta IIs', the single 'Yankee II' and 14 'Yankee Is'. The last generally operate on forward- deployment patrols off the US eastern seaboard, whilst the 'Yankee II', 'Deltas' and 'Typhoons' maintain the 'second-strike' option with their longer-range missiles off the coast of the Soviet homeland in 'sanctuary areas'. The 'Yankees' are tasked with the destruction of time-sensitive targets such as Strategic Air Command bomber bases on alert, and with the disruption of the USA's strategic command, control and communications facilities in the first hours of a nuclear exchange.

The Pacific Fleet has the same missions, and performs them with nine 'Yankee I' and 15 'Delta I' and 'Delta III' units. In recent months it has been revealed that several 'Yankee Is' assigned to the two fleets have been switched to assist the USSR's medium bomber units and the Strategic Rocket Forces' SS-20 and SS-4 'Sandal' IRBM fields in their mission of destroying enemy rear-area infrastructures. The Northern Fleet's 'Typhoon' and SS-N-20 combination has also opened up a new field for Soviet SSBN warfare as the submarines' structure has been designed for operations beneath the ice-pack of the Arctic circle, with sufficient strength for boats to break through the thinner patches in order to fire missiles. This capability was hitherto unavailable to the Soviets, and has complicated the strategic ASW mission for the USA and her NATO allies, as the hunting down of these mammoth craft requires a number of highly trained crews in nuclear attack submarines of the latest quietened design and fitted with the most up-to-date sonar and weaponry technology to ensure that they will be able to get in the first and decisive shot during any under-ice engagement.

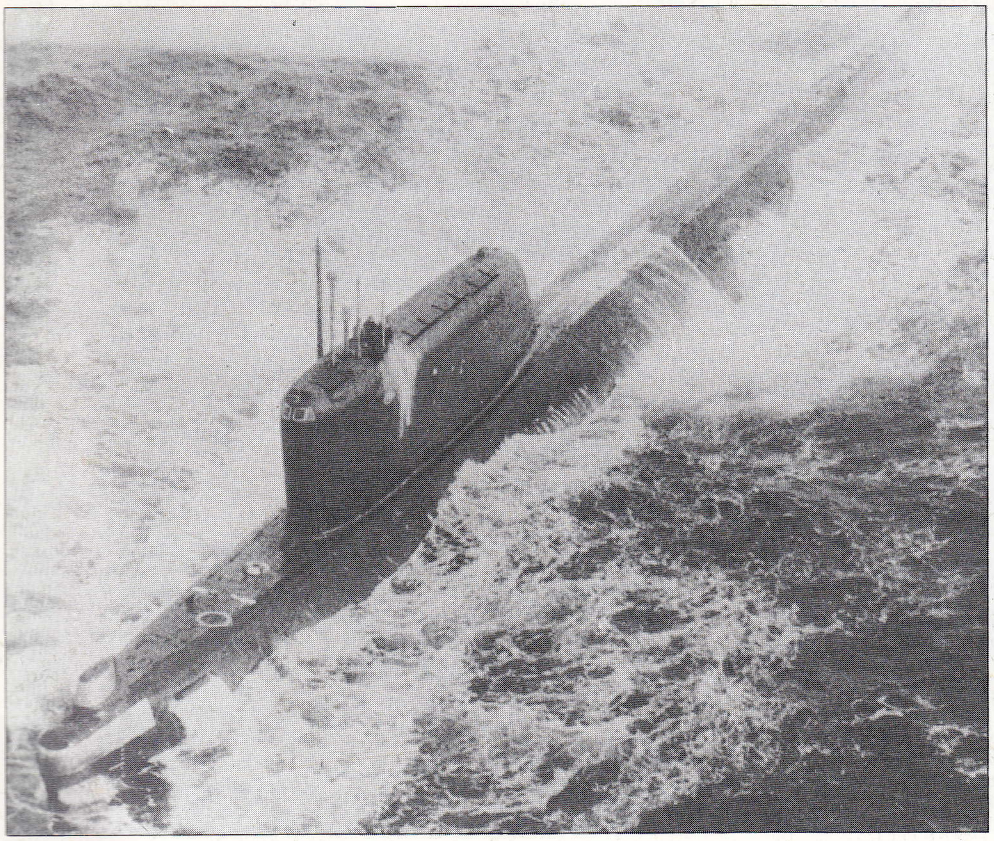
At present only one Soviet shipyard is building SSBNs, that at Severodvinsk on the White Sea. With covered building slips for all-year working, the shipyard has production line building programmes for the 'Delta III' and 'Typhoon' classes. A derivative of the former is expected to replace the class on the slipways in the mid-1980s, whilst 'Typhoon' building will continue at the rate of one unit every other year until the early 1990s at least. The other shipyard which produced SSBNs was in the Far East at Komsomolsk, about 450 km (280 miles) inland of the mouth of the Amur river in Siberia. This yard participated in the 'Yankee I' and 'Delta I' programmes, but then had to switch to nuclear attack submarines as the later SSBN designs are too large to travel down the Amur river to the sea.



Kiev is one of a class of four deployed to the Pacific Fleet (two), Northern Fleet (one) and Black Sea Fleet (one). They carry Yakolev Yak-36 'Forger' VTOL fighters and ASW helicopters.



Above: Kirov carries the heaviest armament seen to date on a Soviet surface combatant, and can act as the command and control centre for a surface action battle group.



Below: One of only a few 'Hotel II' class SSBNs remaining in service in their original role. Recent reports indicate that at least one unit has been converted to a submerged command and control post.